NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

PREPARED BY:

CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT

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ACKNOWLEDGEMENTS

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PREFACE

We all must share our streets with our neighbors. Just as we need to drive on other streets on our way to work, school or shopping, our neighbors need to use our streets, as well. It is the goal of Contra Costa County to make residential streets as quiet and safe as possible, while still providing access for our neighbors and local businesses.

The traffic control measures in this booklet are designed to reduce traffic speed and discourage through traffic on local publicly owned and maintained residential streets, while keeping our neighborhoods accessible to emergency services, public transit, and the residents of Contra Costa County. Most of the control measures are appropriate for local streets and are not recommended for arterial or certain collector streets, where through traffic volumes and speeds are higher.

We encourage you to review this booklet and learn about the neighborhood traffic controls that are available to help slow down and reduce traffic on local residential streets. You can also do your part to help solve neighborhood traffic problems by driving carefully and at reasonable speeds.

For more information, please visit us at www.co.contra-costa.ca.us/depart/pw/ or feel free to call Mark de la O at (925) 313-2234 if you have any questions.

Sincerely,

Contra Costa County Public Works Department

INTRODUCTION

Character of Neighborhood Traffic Controls

Neighborhood traffic controls are installed to enhance traffic and pedestrian safety and preserve neighborhood character and livability. Each device used to influence traffic activity has its own characteristic effects on traffic flow; similar devices can be more or less effective depending on particular site details. Primary effects produced by these controls fall into the broad categories of speed reduction, traffic volume reduction, increased driver awareness and safety.

Success of these controls depend on their use in locations and situations for which they are most effective. When appropriately implemented, the controls are self-enforcing and achieve the intended effect on traffic. When implemented inappropriately, the controls are excessively violated unless aggressive enforcement efforts are made. High demand is placed on the County's traffic enforcement resources, which are provided by the California Highway Patrol, thus limiting the duration of traffic enforcement at any one particular site.

The majority of these controls are intended for use on neighborhood residential streets. Larger roadways such as arterials or collectors that are identified as primary emergency response routes are, for the most part, not appropriate for the use of neighborhood controls.

Purpose of this Document

This document is intended to provide information that will be helpful in identifying the appropriate traffic control measures to address neighborhood traffic problems. It illustrates the types of traffic management measures that can be used to control traffic on residential streets in Contra Costa County. It identifies the types of traffic concerns each measure addresses. It sets forth the conditions that need to exist before each measure is considered for implementation. Additionally, it identifies specific factors that may make the control favorable or unfavorable at a particular location or for a certain purpose. It should be noted that funding sources are not identified in this document and will need to be secured for any device proposed for installation.

The 3E's – Education, Enforcement, and Engineering

Commonly accepted elements needed for successful implementation of a traffic calming program are the "3Es" – education, enforcement, and engineering. The Neighborhood Traffic Management Program employs these three kinds of traffic calming solutions. All of these approaches are considered when designing a traffic calming project. When applying only one of these Es without the other two, the end result may be less than satisfactory. County Traffic Engineering staff will work closely with all interested citizens to identify the problem and design an integrated approach to develop measures that consider the "3Es": Education, Enforcement, and Engineering.

Education

Education plays a crucial role in traffic calming and assists residents in making informed decisions about traffic concerns. It promotes neighborhood awareness and community building, and is the most readily implementable means of modifying driver behavior. In many cases, the problem drivers are your neighbors, and discussions among the neighbors can help to reduce the problem.

Enforcement

Enforcement efforts such as speed monitoring trailers and increased citations are obvious deterrents to problem drivers, but are heavily dependent on available manpower and equipment. One of its key benefits of enforcement is responsiveness. The County utilizes its available resources to respond to areas experiencing traffic problems as identified by resident complaints, collision history, and observations by enforcement officers.

Engineering

Engineering tools include a variety of traffic calming devices that can reduce speed, decrease traffic volumes, and improve safety. These devices, when properly implemented, help to ensure that the cumulative negative impacts associated with one traffic calming feature do not multiply and/or result in a large-scale problem. In deciding which traffic calming devices will work best for a particular street, a number of considerations must be weighed:

- Devices can have both benefits and disadvantages. For example, a device that effectively slows traffic on one local street may result in diverting traffic to another local street, which may impact emergency vehicle response time.
- Some devices may be generally appropriate for local streets, but cannot be used on particular streets because of traffic or physical conditions.
- Specific neighborhood characteristics must be taken into account. Residents may want to consider how traffic devices might affect aesthetics, parking needs, or other issues important to the neighborhood.

The drawings, photos, and sketches in this document are for purposes of illustrating the concepts involved; they do not constitute engineering design recommended for any specific location in Contra Costa County. Applications at each individual site must be carefully designed or overseen by a competent registered professional engineer.

Contra Costa County and other communities are always looking for better measures for controlling traffic on residential streets. Not all measures used in other communities are included as some are in experimental stages and some are overly restrictive. Measures that prove to be appropriate and effective for use in residential street settings may be considered for use in the future. The measures illustrated in this document are a range of controls currently considered appropriate for use in Contra Costa County.

In addition, Contra Costa County is reexamining its design standards so that new residential developments are built with neighborhood livability as a priority. This may preclude the future need for expensive traffic calming device installations on newly built-out developments.

Related Criteria and Policies

There are several related criteria and policies of Contra Costa County and the State of California that provide a framework for the warrants, design, implementation, operation, and enforcement of traffic controls.

Various criteria, and a weighted point system assigned to every criterion, are used to determine if the project will be considered for implementation. This rating system is included in the "Ranking Projects" section of this volume.

Policies need to be considered when planning and developing neighborhood traffic control installations. Among these are the following:

Emergency response - prior to the installation of any permanent traffic-calming devices, emergency response services shall be notified. The emergency response agencies shall be included in the traffic-calming improvement discussions with the community. Items that need to be addressed include delay time, turning radius, and notification of improvements/restrictions.

Prioritization methodology – priority will be based on the rating system prescribed under the "Ranking Project" section of this volume. The County's policies and methodology for prioritizing the installation of needed controls within prevailing budgetary constraints will affect the timing of implementation. Safety concerns demonstrated by reported collisions may increase the priority of a given project.

Street development and operation standards - the County's street improvement and operational standards will affect the design and installation of individual measures.

Manual on Uniform Traffic Control Devises (MUTCD) and California Supplement - the design and use of all traffic control measures within the State of California are affected by the roadway development and roadway operation practices contained in these manuals. Deviations from these practices create the potential for problems to arise from driver confusion produced by non-standard devices or installations.

Enforcement programs and resources - the County's traffic law enforcement programs and resources will affect the success of some installations that may need aggressive enforcement efforts to be effective.

Emergency Routes – streets that are designated as emergency routes by emergency response agencies are not eligible for the Neighborhood Traffic Management Program.

Residential Streets – the traffic calming devices contained in this volume are intended only for residential streets.

Neighborhood Circulation – traffic control installations should not divert traffic to other residential streets that are not able to accommodate the additional traffic load.

Contra Costa County Neighborhood Traffic Management Program

The Contra Costa County Neighborhood Traffic Management Program (NTMP) represents the County's commitment to the safety and livability of its neighborhoods. It is a community-based approach to traffic calming. The program is designed to educate and empower residents with the tools to evaluate, develop, and program traffic management solutions.

The Program, along with the Tool Kit presented herein, provides a process for identifying, measuring, and dealing with problems related to traffic safety on local streets. This process also facilitates the County's goal to "provide for safe and efficient vehicular, pedestrian, and bicycle movements on Contra Costa County streets."

Background

Traffic calming began in Europe around 1970 as a non-traditional way to reduce traffic speeds and problems on residential streets. Today, around the world and throughout the United States, traffic-calming techniques and approaches vary and are still being tested. Some communities simply lower speed limits or install stop signs in areas with speeding problems. Engineering professionals do not typically recommend this approach because it often results in driver disregard for speed limits and stop signs.

Other communities, such as the cities of Saratoga, Redwood City, Mountain View, Cupertino, Menlo Park and the town of Danville, employ a comprehensive and systematic Neighborhood Traffic Management Program (NTMP) to address all types of neighborhood traffic issues. The adoption of the Contra Costa County NTMP moves Contra Costa County into the group of agencies that are committed to proactively and effectively addressing the traffic concerns of its residential neighborhoods.

GOALS OF THE NTMP PROCESS

1. Neighborhood Livability

Contra Costa County places a high value on neighborhood safety and livability. Although livability has no precise definition or measure, it can be thought of encompassing the following characteristics:

- Feeling of safety and security in neighborhoods.
- Opportunity to socially interact with neighbors without traffic distractions or threats.
- Ability to experience a sense of home and privacy.
- Ability to establish a sense of community and neighborhood identity.
- Develop a balanced relationship between the multiple uses and needs of a neighborhood.

Traffic management plays a vital role in promoting these neighborhood characteristics. The Neighborhood Traffic Management Program (NTMP) recognizes that vehicular traffic is only one element of a neighborhood and that other residential needs must be given careful consideration.

2. Citizen Participation

Through use of the process outlined in this NTMP, residents can evaluate the various benefits and trade-offs of projects within their own neighborhood and can become actively involved in the decision-making process.

3. Street Ambiance

During the process of implementing a traffic-calming plan, many opportunities arise to greatly improve the streetscape so it becomes an extension of resident's front yards. For example, with the development of an assessment district, medians and traffic circles can be gracefully landscaped to enhance the street and provide additional ambiance in the neighborhood.

THE TWO PHASE PROGRAM: HOW IT WORKS

The NTMP process has two phases. The first phase (Phase I) focuses on education and enforcement, and providing the neighborhood with tools for resolution and documentation of the traffic problem(s). Phase I measures should be thoroughly explored and implemented before moving on to Phase II.

If the traffic issue(s) still exists after the first phase, then more restrictive physical devices included in Phase II can be considered. These restrictive devices can include installations such as speed humps, traffic circles, chokers, and islands.

The NTMP process is diagrammed on the following page, and described below.

Getting the Process Started

- ***Staff Review & Initiation***

  Traffic concerns are reported to the County Traffic Engineer who will help residents gather preliminary data, including volume, speed and accident information and develop petitions.

  If preliminary data reveals that traffic problems are persistent neighborhood-wide and meets minimum requirements and ranking criteria (see "Ranking Projects" section), County staff will help the residents implement the NTMP process.

  However, if the data reveals that either a simple solution or an immediate hazard to the public exists, County staff may address the problem directly and not initiate the NTMP process.

- ***Neighborhood Boundaries***

  The boundaries of the participating neighborhood can be initially defined with input from this NTMP. Boundaries will be confirmed by the County Traffic Engineer before the traffic calming process is launched. These boundaries are open for discussion and possible revision during the first neighborhood meeting.

- ***Neighborhood Survey***

  Residents will prepare a survey to circulate within the participating neighborhood. This survey will determine the level of agreement among residents that there is a traffic problem the residents want to address through the NTMP process.

  This survey must show all addresses within the defined neighborhood, and be signed by a simple majority (50%+1) of the households and/or businesses shown. Each household or business is entitled to one signature. If there is substantial interest to participate in the program, then the process moves forward to Phase I.

Contra Costa County Neighborhood Traffic Management Program

Residents identify traffic concern

Residents contact County Traffic Engineer

Simple solution or urgent action required?

Yes

County Traffic Engineer takes direct action. End process

No

Residents gather data with staff assistance
Study area boundaries and qualifying criteria identified
Residents circulate petition

50% + 1 signatures obtained?

No

PWD determines if action is required. May refer to staff for non-NTMP solutions. End process

Customer Service Process

NTMP Process

Yes

Neighbors hold meeting with NTMP process. Select spokesperson. Set goals. Education and enforcement resources made available to neighbors.

Neighbors decide if Phase 1 efforts are adequate

Yes

End process

No

PWD evaluates need to proceed to Phase 2

No

End process

Yes

Begin next step
Study traffic calming measures and define Plan

Neighbors circulate a petition to demonstrate a support by 2/3 majority of residents in the affected area and 100% of those residents directly affected

No

End process

Yes

PWD approves Plan , authorizes funding up to $10,000

Cost over $10,000

TWIC & County Board of Supervisors approves Plan, authorizes funding over $10,000

Cost under $10,000

Environmental review[1] TWIC & County Board of Supervisors approves

Environmental review[1] County Board of Supervisors approves

Install project, compare results to goals. Fine tune and retest if needed.

End process

Notes:
[1]County staff will determine the level of environmental review necessary to satisfy CEQA requirements.
TWIC = Transportation, Water & Infrastructure Committee.
Assumptions:
1) Annual CIP funding for traffic calming will be provided by the County Board of Supervisors for projects approved by the TWIC up to a fixed budget amount ($10,000)
2) Solutions assume CIP Funding by the County Board of Supervisors

Phase I: Education & Enforcement

Phase I of the traffic calming process involves identifying specific concerns, establishing goals and objectives, defining criteria for "success," and developing a Neighborhood Traffic Plan with measures for implementation.

Examples of Phase I Measures include, but are not limited to, the following:

- Neighborhood Speed Watch – collecting travel speed data with a borrowed radar gun or a portable unmanned trailer equipped with radar and a speed limit sign placed so that motorists are aware of their actual speeds in contrast to the posted speed limit
- Neighborhood Traffic Safety Campaign – targeted distribution of educational materials regarding traffic safety issues
- Neighborhood Outreach – posting signs asking drivers to slow down, or passing out flyers to problem drivers asking them to modify their behavior (note: flyers should only be given to drivers who willingly stop, it is not the intent of this document to encourage residents to force unwilling drivers to stop their cars and receive a flyer)
- Targeted Law Enforcement

Each neighborhood participating in the program must begin with Phase I. The public education provided in Phase I enable residents to distinguish between real and perceived speeding problems, and begin the discovery process necessary for change. As is often the case, the speeders are residents of the neighborhood.

Steps for Implementation of Phase I

The following is a step-by-step approach to implementing Phase I of the NTMP process:

Step 1: Kick-Off Meeting
Residents will organize a community meeting with other neighborhood residents to introduce the NTMP process to residents:

- Distribute and discuss program materials;
- Finalize neighborhood Project Area boundaries;
- Identify specific traffic concerns and issues as real or perceived problems;
- Discuss any traffic control measures previously implemented;
- Establish goals and objectives of the neighborhood;
- Define criteria for "success" of the program;
- Establish a Neighborhood Traffic Committee (NTC) to work closely with County staff during this process, if necessary;
- Elect a chair of the NTC to schedule meetings and serve as the point of contact for County staff, if necessary.

Step 2: Data Collection
With the specific traffic concerns expressed at the Kick-Off Meeting, residents can work with the County Traffic Engineering Staff to conduct a thorough analysis of the traffic issue. This involves collecting and analyzing travel speed and traffic volume data, and may also address collsion data, traffic volumes, neighborhood citation history, and other community problems.

Step 3: Re-Group Meeting(s)
The neighborhood will re-group to discuss the analysis of the data collected. If the data shows that the situation meets the minimum qualifying criteria, the NTC and County staff will work together to develop Phase I measures designed to meet the established objectives. At this meeting, a trial period will be established to analyze the effectiveness of Phase I measures.

Step 4: Implementation and Trial Period
Phase I measures will be implemented for a period of one to six months, as established by the NTC and County Staff. The NTC will measure the effectiveness of Phase 1 measures using the criteria for "success" established during the Kick-Off Meeting, and review the findings with the County Traffic Engineer.

Phase I measures may include the following:

- Public outreach
- Speed limit signs
- Use of a speed-radar trailer that displays a speed limit sign and the actual travel speed of a passing motorist
- Targeted law enforcement

Step 5: Phase I Evaluation Meeting
The NTC and County staff will meet to review the results of the Phase I measures and its effectiveness.

Phase II: Traffic Calming Devices

If the Phase I measures were not effective or "successful," as defined by the neighborhood's criteria, or if the Phase I results are only temporary, residents may elect to move to Phase II of the program.

In Phase II, a Neighborhood Traffic Plan (NTP) may be developed to include the placement of physical devices on neighborhood streets. Phase II measures are typically more costly and may require involvement of appropriately licensed professionals. Consequently, each project area will have a budget (as funding permits), and may be subject to the review and approval of the Transportation, Water, and Infrastructure Committee (TWIC) and the County Board of Supervisors.

Examples of Phase II Measures include, but are not limited to, the following:

- Undulations (Speed Bumps)
- Undulations (Speed Table)
- Traffic circles
- Curb Bulbs (Chokers)
- Pedestrian Islands
- Intersection Table
- Gateway Treatment
- Semi-Diverters (partial street closures)
- Cul-de-Sac (full street closure)

Approval of Phase II Measures

The NTP developed in Phase II, Category 1 will require a simple majority neighborhood consensus for implementation, while the NTP developed in Category 2 or 3 will require a two-thirds majority neighborhood consensus and 100% approval of those residents directly affected (i.e. device installed along property frontage) for implementation. A petition drafted by the Neighborhood Traffic Committee (NTC) and approved by the Traffic Engineer will be circulated throughout the defined Project Area. Each household or business is entitled to one signature.

According to the State of California Vehicle Code, restrictive measures such as those proposed under Phase II can only be implemented by ordinance or resolution by the County Board of Supervisors.

Some Phase II measures may also generate potentially significant physical impacts and may require the preparation of an environmental document, as required by the California Environmental Quality Act (CEQA). The County Board of Supervisors must review and approve an environmental document prepared by County staff for the NTP.

The Phase II measures discussed in this NTMP are divided into three categories. Category 1 includes devices that require minimal environmental review and can be implemented quickly. Category 2 contains devices that may require moderate environmental review because of potential traffic impacts outside the neighborhood. Implementation of Category 2 devices may require several weeks of review before a project can be implemented. Similarly, Category 3 devices may cause extensive traffic diversion, and may require several months or more of review before a project can be implemented.

Steps for Implementation of Phase II

See the following "Tool Kit" section of this document.

TOOL KIT for PHASE II

After testing public outreach and law enforcement to achieve the goals adopted by a Neighborhood Traffic Committee (NTC), a Neighborhood Traffic Plan (NTP) may be developed to include the placement of physical devices on neighborhood streets. This tool kit provides traffic management policies that are both proactive and preventive measures. The tool kit is divided into three categories that increase the degree of traffic control within a neighborhood. The categories are as follows:

- **Category 1** involves residents and County staff working together to identify the traffic concerns of the neighborhood and how these concerns can be addressed by simple measures such as striping changes or parking restrictions. Category 1 measures can typically be implemented without extensive environmental review or involvement of licensed engineers.

- **Category 2** uses more restrictive measures that may divert traffic and or may alter access to property. Category 2 is initiated if Category 1 measures are believed to be ineffective, or if there are no feasible Category 1 measures that fully address neighborhood concerns. Category 2 measures should be developed under the direction of appropriately licensed professional and emergency response agencies, and may require environmental review. Category 2 measures will require more study than Category 1, and will take more time to implement an NTP.

- **Category 3** uses the most restrictive measures that will divert traffic, such as street closures or diverters. Category 3 is only initiated if Category 2 measures are believed to be ineffective in a trial implementation or if there are no feasible Category 2 measures that address the neighborhood concerns. Category 3 measures shall be developed under the direction of a licensed professional engineer and emergency response agencies, and may require detailed environmental review. The time required to study Category 3 measures and complete the required environmental review will be considerably longer than Category 1 or 2.

Initiating a Traffic Calming Study

A neighborhood desiring a Phase II traffic-calming project must submit a petition letter to the Contra Costa County Public Works Department's Traffic Section that explains the problems and the results of the Phase I efforts. The petition letter shall also include a map showing the location of the problem and boundaries of the impacted neighborhood, along with copies of the signed petitions from the Phase I effort. The Public Works Department will receive the petition letter and copies of the signed petitions and take action on a first-come-first-served basis.

County Staff will review the petition letters and ensure that all affected areas are included. Once the boundaries of the neighborhood are established, the County staff will organize a kick-off meeting to present the boundaries and discuss the traffic concerns with the residents.

Category 1

Prior to the kick-off meeting of Phase II, the County staff will conduct a field review to check the existing conditions and collect the traffic data necessary to make informed decisions. At the kick off meeting, the County staff will present the boundaries of the neighborhood and the data collected. In addition, County staff will discuss with the residents the neighborhood traffic concerns and will plan the following:

- The number of subsequent meetings
- The date, time, and location of these meetings.

In subsequent meetings, the NTC and County staff will work together to develop a traffic-calming plan for the neighborhood, which addresses the neighborhood's traffic concerns. The traffic measures used for Category 1 are simple, low cost and measures such as visibility, signing, and striping improvements. The Category 1 measures include:

- Neighborhood Traffic Safety Campaigns-targeted distribution of educational materials regarding safety issues to local residents.
- Striping changes/improvements such as addition or removal of turn lanes or bike lanes
- Parking restrictions
- Crosswalks
- "Bots" dots (pavement markers), reflective markings
- Use of a radar-speed trailer in neighborhood

The NTC shall develop a plan with the assistance of County staff. A petition shall be circulated among residents to determine whether or not the plan should be implemented, with approval requiring a simple majority of signatures in support of the plan.

If Category 1 measures <u>are</u> believed to be adequate and favored, the plan is implemented for a trial period of at least two months. At the end of the trial period, County staff will collect the necessary traffic data to evaluate the effectiveness of the measures.

If the Category 1 measures are <u>not</u> believed to be adequate or favored, or if the measures are unsuccessful in addressing the traffic concerns of the neighborhood during a trial period, Category 2 measures may be studied.

Category 2

Category 2 measures are more restrictive traffic control devices, which may divert traffic and impact access to property. The traffic measures used for this category are higher in cost and include the following devices:

- Undulations (Speed Humps)
- Undulations (Speed Tables)
- Traffic Circles

- Curb Bulbs (Chokers)
- Pedestrian Islands
- Modified Tee Intersections
- Chicanes
- Intersection Tables
- Gateway Treatments

The Category 2 process is similar to the Category 1 plan process. First, the County staff plans the number of subsequent meetings and the date, time, and location of the meetings. In subsequent meetings, the NTC will develop a plan with the assistance of County staff. The plan and ballots are sent to each impacted household within the neighborhood.

Since Category 2 plans may include more restrictive and costly devices, petitions demonstrating support by a two-thirds majority of residents in the affected area and 100% of those residents directly affected (i.e. device installed along property frontage) must be confirmed before the County will take action to implement a plan. Emergency response agencies will also need to support any proposed improvements to ensure adequate access is provided.

If Category 2 measures <u>are</u> believed to be adequate and favored, the plan advances to environmental review. County staff will determine the level of review required. Upon completion of environmental review, the NTP is implemented for a trial period of at least two months. At end of the trial period, County staff will collect the necessary traffic data to evaluate the effectiveness of the measures.

If the Category 2 measures are <u>not</u> believed to be adequate or favored, or if the measures are unsuccessful in addressing the traffic concerns of neighborhood during a trial period, Category 3 measures may be studied.

Category 3

A Category 3 study considers traffic diversion measures and thus requires the following:

1. A review of potential environmental impacts of the traffic -calming devices, which is required by the California Environment Quality Act (CEQA).
2. Approval from the TWIC
3. Approval from emergency response agencies
4. Approval from the County Board of Supervisors

The Category 3 measures may include:

- Diagonal Diverters
- Semi-Diverter/Channelization
- Cul-de-Sac

The plan development process is similar to Category 2, with a two-thirds majority vote of the neighborhood required for approval. The plans must also clear the CEQA process and approvals by both the TWIC and County Board of Supervisors.

Removal of Traffic-Calming Devices

Any traffic-calming measure can be removed in all Category plans at any time. Removal of traffic-calming measures requires a petition signed by a simple majority (50% plus one) of residents in favor of removing the devices, or if the county determines that the measures have become a safety issue. Removal of traffic-calming devices will be scheduled on a first-come-first-served basis.

Description of Traffic-Calming Devices

The various traffic-calming devices discussed above are shown on the following pages. A description of traffic control devices that are often requested by residents is also included.

TOOL KIT
TRAFFIC-CALMING DEVICES
CATEGORY 1

RADAR-SPEED TRAILER – CATEGORY 1

Description: A device owned and operated by the Public Works Department and can be positioned in the parking lane or shoulder of a County street. A standard speed limit sign matching the posted speed for the street is prominently displayed alongside or near an electronic output that shows the actual travel speed of an approaching vehicle. The device can record the speed and time of day of each passing vehicle.

Objective: Obtain compliance with posted speed limit.

Specific Applications: Used on any street classification as long as space is available to park the trailer.

Prerequisites & Constraints: Must be appropriately supported by the neighborhood. Best results occur in straight roadway sections. Use is subject to priority. Benefits occur while trailer is in place and for a few days thereafter.

Advantages: Studies of this device demonstrate good effectiveness while the device is in position. Speed limit compliance benefits can continue after removal of the device for several weeks, gradually diminishing.

Disadvantages: Use of the trailer in curved sections can result in inaccurate travel speed-readings. Drivers generally return to previous speeds soon after the sign is moved.

Minimum Requirements: A simple majority of residents in neighborhood must sign a petition indicating a need to reduce traffic speeds.

Alternate Devices/Strategies: Targeted law enforcement.

Cost (Typical): $15,000 per unit. Placement of this equipment can be made at no cost to residents.

STRIPING AND PAVEMENT MARKINGS – CATEGORY 1

Description: Painted or thermoplastic markings on the pavement to delineate the roadway for controlled use. Markings may include double yellow lines, shoulder stripes, bike lane stripes, or text.

Objective: Control and constrict vehicle travel paths to encourage slower speeds. Delineate areas of pavement for use by pedestrians or bicyclists.

Specific Applications: Used on any street classification as long as width is available to maintain 10 feet (minimum) travel lanes and 7 feet (minimum) parking lanes, as appropriate.

Prerequisites & Constraints: Must be appropriately supported by the neighborhood. Results may be mixed with minimal speed reduction. Best success is for delineating no-auto portions of the pavement.

Advantages: Relatively low cost application, effective 24 hours a day. May enhance pedestrian and cyclist use of roadway.

Disadvantages: May not be effective on all drivers.

Minimum Requirements: A simple majority of residents in the neighborhood must sign a petition indicating a need to delineate the roadway.

Alternate Devices/Strategies: Sidewalks, chokers.

Cost (Typical): $10 per square foot of striping.

SPEED AND WARNING SIGNS – CATEGORY 1

Description: Speed and warning signs, including pavement legends, are the easiest and simplest of the techniques on this list. The purpose of posting the speed limit on a residential street is to inform the motorist of the prima facie speed limit of 25 miles per hour and to attempt to gain compliance with the speed limit. Warning signs provide information to the motorist. Fabrication and installation of a sign is a low-cost item. However, the effectiveness of the signs is short-lived and motorists who travel the area soon pay no attention to them. Also, a proliferation of signs could cause visual blight or visual pollution in some neighborhoods.

Objective: Obtain compliance with posted speed limit.

Specific Applications: Used on any street classification.

Prerequisites & Constraints: Must be appropriately supported by the neighborhood.

Advantages: Signage complements directed enforcement efforts and gives drivers fair warning of speed limits. Pavement legend(s) complement signage and must comply with State and Municipal Codes.

Disadvantages: Excessive signage can divert driver attention from the road.

Minimum Requirements: A simple majority of residents in neighborhood must sign a petition indicating a need to reduce traffic speeds.

Alternate Devices/Strategies: Targeted law enforcement.

Cost (Typical): $300 per sign. $600 per pavement legend.

DRIVER FEEDBACK SIGNAGE – CATEGORY 1

Description: Gives the motorist passing real-time feedback as to their vehicle's speed. Light Emitting Diodes (LEDs) can be programmed to flash when motorist exceed the speed limit. The sign can also "blank" at a set maximum speed. If a motorist exceeds the posted speed limit, the current vehicle speed will flash with increasing frequency.

Objective: Obtain compliance with posted speed limit.

Specific Applications: Used on any street classification.

Prerequisites & Constraints: Must be appropriately supported by the neighborhood. Funding (other than Road Funds) must be obtained.

Advantages: Signage is very effective in obtaining voluntary compliance to the speed limit with less enforcement.

Disadvantages: High cost to pay for the sign, power and installation is associated with these signs. While these signs can be considered Category 1 measures, the time required to fund the installation of these signs could be lengthy, similar to Category 3 measures.

Minimum Requirements: A simple majority of residents in neighborhood must sign a petition indicating a need to reduce traffic speeds and funding (other than road funds) must be available.

Alternate Devices/Strategies: Targeted law enforcement.

Cost (Typical): $10,000 per sign.

RUMBLE STRIPS – CATEGORY 1

Description: Rumble strips consist of raised ceramic markers that are designed to alert drivers to dangerous or unexpected conditions. On local streets their purpose is to alert drivers of the need to pay attention to special conditions.

Objective: Alert drivers to special conditions such as curves or crosswalks.

Specific Applications: Used on any street classification.

Prerequisites & Constraints: Must be appropriately supported by the neighborhood.

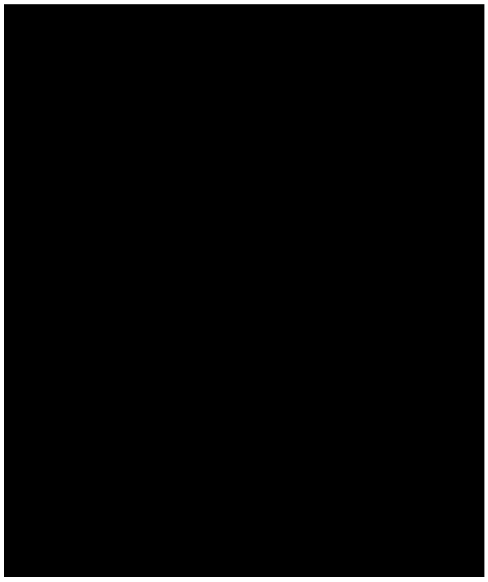
Advantages: Increased driver awareness is a commonly accepted benefit.

Disadvantages: This alternative has had a mixed response in cities where it has been implemented. The objection to the rumble strips lies in the noise that is created by vehicles traveling over the strips. In some neighborhoods, the noise seems to be more intrusive than in other neighborhoods. Bicyclists may find the rumble strips to be objectionable and therefore are not recommended on bicycle routes. Increased maintenance may also be required.

Minimum Requirements: A simple majority of residents in neighborhood must sign a petition indicating a need to reduce traffic speeds. Residences directly fronting the rumble strip location must support the installation.

Alternate Devices/Strategies: Targeted law enforcement.

Cost (Typical): $500 per lane.



CURBSIDE TREES – CATEGORY 1

Description: The purpose of planting trees in the curbside or parking strip area in front of the sidewalk of a residential or collector street is to give the impression of a narrower street and thus slow traffic. Mature trees can create a tunnel effect that discourages excessive speeding. A variation on this planting idea is to place trees at selected parking space locations along the street. Criteria for the installation of trees include the following:

- Other traffic management devices are not acceptable to the emergency response services.
- The neighborhood is opposed to other measures or measures previously installed are not as effective as desired.
- The neighborhood is deficient in street landscaping.
- Adequate site conditions, such as right-of-way and sidewalks, that allow for the installation of the trees.

Objective: Obtain compliance with posted speed limit.

Specific Applications: Used on any street classification.

Prerequisites & Constraints: Must be appropriately supported by the neighborhood. When trees are planted in planter strip areas, root barriers are recommended.

Advantages: Trees act as a buffer zone between motorists and pedestrians and also provide a visual barrier between the two. Trees have no impact on the volume of traffic but have a minor impact on speed. Trees can improve street ambiance, and to be effective, should be planted consistently along street frontages approximately every 30 to 50 feet.

Disadvantages: Increased maintenance may be required. Impacts are not immediate as the trees will need several years to mature.

Minimum Requirements: A simple majority of residents in neighborhood must sign a petition indicating a need to reduce traffic speeds.

Alternate Devices/Strategies: Targeted law enforcement.

Cost (Typical): $100 to $300 per tree. Cost varies with type and size of tree selected. Total cost varies with block length and installation type desired.

Note: This option is only available 1) if planted in areas that currently are the responsibility of the property owners to maintain; 2) if the local neighborhood already has an assessment district established that is willing to accept additional responsibilities or 3) if a new assessment district is established to collect funds in the form of taxes to pay for the installation and maintenance of the trees.

Dana Street in Mountain View

TOOL KIT
TRAFFIC-CALMING DEVICES
CATEGORY 2

UNDULATIONS (SPEED HUMPS) – CATEGORY 2

Description: Gradual rise and fall in pavement surface, generally to a maximum height of 3.25 inches in a circular arc projected over a 12 or 14 foot chord in the direction of travel. Speed humps create an undulation (variation) in the roadway surface.

Objective: Reduce vehicle speed.

Specific Applications: Used on local streets or collectors that is not identified as emergency response routes experiencing speed problems. Should be considered when 85th percentile speed exceeds 32 mph, 50% of vehicles exceed 25 mph, or maximum travel speeds are 20 mph or more above the posted speed limit.

Prerequisites & Constraints: Street must have 25 mph speed limit. Street cannot be classified as an arterial nor have more than two travel lanes. Street cannot be a principal emergency vehicle route, public transit route or truck route. Undulations should not be placed on blocks serving as primary access route to significant truck traffic generator, even if not designated as truck route.

They should not be placed on grades exceeding 8 percent, at points within 150 feet of intersections or where horizontal and/or vertical alignment limits sight distance. They cannot be placed over or very close to manholes, utility valves, or street monumentation. They should be placed on streets in which the traffic volume is between 500 and 2,000 vehicles per day. When feasible, they should be located to take advantage of existing street lighting fixtures on or close to property lines or to take advantage of side-lot frontages. Speed humps are ideally used on streets with vertical curbs. For streets with rolled curbs or no curbs, drivers may steer around the hump and into front yards to avoid the installation.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation (one vote per residence). ***All*** residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within three blocks or 2000 feet; whichever is less, on either side of the proposed speed hump locations. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Advantages: Highly effective, modest cost, self-enforcing. Undulations may produce minor traffic diversions. Speed Humps are recognized as different from common "speed bumps," which are regarded as unsafe for use in the public right-of-way. Some jurisdictions are using undulations with profiles longer than 12 feet in the direction of travel (most commonly 20 feet) in efforts to lessen the severity of effect on long wheelbase vehicles or to make the undulations more appropriate to driver expectations of travel along urban streets.

Benefits include reduction in 85th percentile speeds of 3-4 mph, and reduction of maximum speeds of 5-10 mph. Speed reduction may not occur for the first several days after the installation. Typically install two undulations per block (800 feet maximum spacing), installing only one undulation may reduce the level of benefit.

Disadvantages: Lengthens emergency response time. Vehicles braking and accelerating create noise. May lower property values. Can cause discomfort for passengers of ambulances or those

with chronic painful physical conditions. Can restrict mobility for people using wheelchairs if installed where there are no sidewalks.

Alternate Devices/Strategies: Circles, curb bulbs, serpentine, enforcement.

Cost (Typical): $3,000 (asphalt paving) to $8,000 per block (brick paving).

Undulations

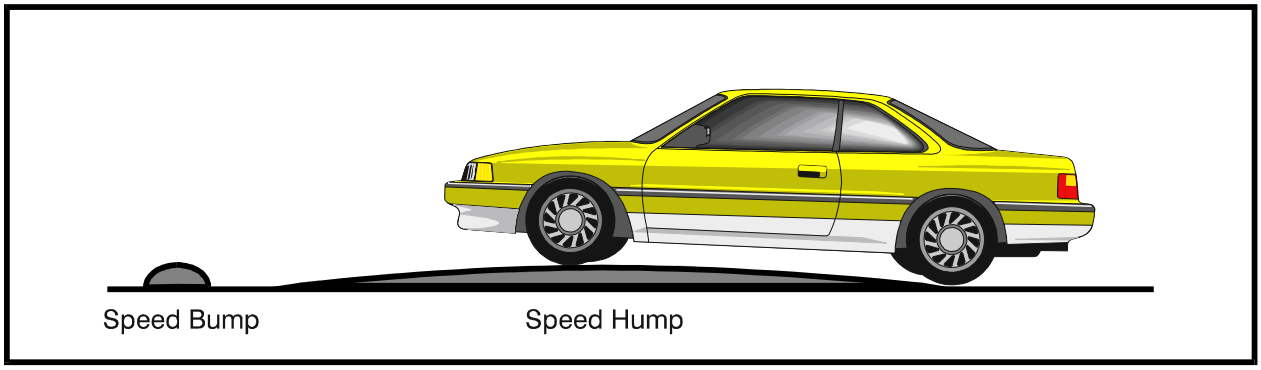


Figure 2a - The Difference between a "Common Speed Bump" and a "Speed Hump."

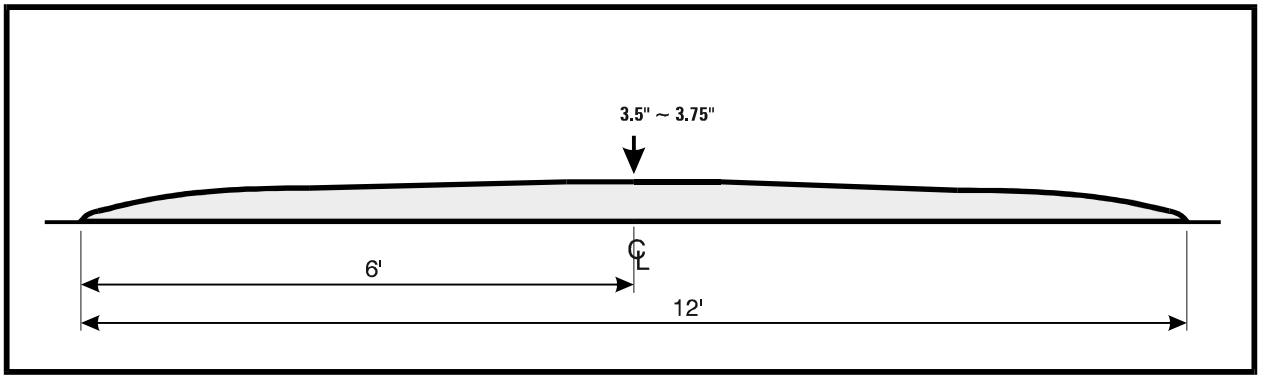
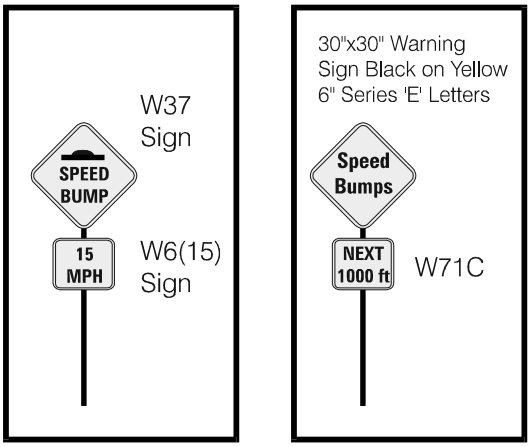


Figure 2b - Typical Undulation Dimensions.
(Along Center Line of Road)

Figure 2c - Typical Oakland Installation.



Adjacent to Undulation. *Advanced Warning Sign (where appropriate).*

Figure 2d - Warning Signs.

UNDULATIONS (SPEED TABLE) – CATEGORY 2

Description: Gradual rise and fall in pavement surface, generally to a maximum height of 3.25 inches with a flat top to accommodate a cross walk. Speed tables create an undulation (variation) in the roadway surface.

Objective: Reduce vehicle speed.

Specific Applications: Used on local streets or collectors that is not identified as emergency response routes experiencing speed problems. May be considered when 85th percentile speed is 8 mph or more above the speed limit, or maximum travel speeds are 20 mph or more above the posted speed limit. Typically used at intersections or in business districts to provide for pedestrian crossing.

Prerequisites & Constraints: Street must have 25 mph speed limit. Street cannot be classified arterial nor have more than two travel lanes. Undulations should not be placed on blocks serving as primary access route to significant truck traffic generator, even if not designated as truck route. Undulations may increase access time of emergency vehicles.

They should not be placed on grades exceeding 8 percent, at points where horizontal and/or vertical alignment limits sight distance. Also, cannot be placed over or very close to manholes, utility valves, or street monumentation. Speed tables are ideally used on streets with vertical or rounded curbs, as the hump will conform to the walk.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation (one vote per residence). ***All*** residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within three blocks or 2000 feet; whichever is less, on either side of the proposed speed table locations. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Advantages: Highly effective, modest cost, self-enforcing. Undulations may produce minor traffic diversions.

Benefits include reduction in 85th percentile speeds of 3-4 mph at the speed table, and reduction of maximum speeds of 5-10 mph. Speed reduction may not occur for the first several days after the installation.

Disadvantages: Due to conform to the curb, drainage may be altered. Emergency response time will be lengthened. Vehicles braking and accelerating create noise. May lower property values. Can cause discomfort for passengers of ambulances or those with chronic painful physical conditions.

Alternate Devices/Strategies: Speed humps, circles, curb bulbs, serpentine, enforcement.

Cost (Typical): $4,000 (asphalt paving) to $9,000 per block (brick paving).

TRAFFIC CIRCLES - CATEGORY 2

Description: Raised islands placed in the middle of an intersection; not necessarily precisely centered or exactly circular.

Objective: Reduce speed. Increase safety by establishing predictable flow patterns at intersections. Reduce broadside collisions.

Neighborhood Traffic Applications: Used at intersections on streets where more restrictive speed or volume measures (like undulations, cul-de-sacs) are undesired or inapplicable; where speed problems are focused at intersections; or where unusual intersection geometry and excess traveled-way surface creates unpredictable flow patterns and conflict points.

Prerequisites & Constraints: Used for speed control on local access streets only. Speed control effect on most vehicles within 200 feet of the intersection (similar to STOP signs), although circles have a mid-block speed control effect on the fastest vehicles. Circles are best used where the desire is to control speed near intersections or to affect mid-block speeds of the fastest vehicles, rather than speeds of average drivers. Effects on speed may be intensified if used at a sequence of intersections or in combination with other devices to create a cumulative effect.

Size and specific shape must be customized to individual intersection geometry. Intersecting streets normally must both be in excess of 30 feet curb-to-curb width to allow adequate space for the circle and traffic lanes. Circle diameters are typically 12 feet or more. The raised islands require good sight distance and level-to-moderate grade conditions. Middle of the intersection positioning gives rise to the need for good visibility across the circle and makes circles susceptible to being struck by errant traffic. High-visibility materials, reflective signs and markings, and mountable materials should be used.

Reconstruction/relocation of manholes, utility valves, and street monumentation may be required.

Advantages: Benefits include reduction in 85^{th} percentile speeds of 1-2 mph, and reduction of maximum speeds of 5-10 mph. Studies suggest broadside accident reductions of 50 to 90 percent. Rarely causes traffic diversion. Landscaped traffic circles can improve street ambiance.

Disadvantages: Emergency services may find circles nearly as problematic as cul-de-sacs or diverters. Application requires careful consideration of emergency service needs. Parking limitations on intersection approaches may be needed. Bicycle and pedestrian paths must be redesigned around new vehicle paths.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation (one vote per residence). ***All*** residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households for within one block or 1000 feet; whichever is less, on each side of the proposed traffic circle locations. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Undulations, curb bulbs, chicanes.

Cost (Typical): Depends on size of island and pavement area. For a typical residential streets intersection, at approximately right angles, approximate cost are $8,000 hardscaped; $25,000 landscaped (not including the additional cost for an assessment district).

Traffic Circles

Low Cost Circle in Mountain View

Medium Cost Example of a Traffic Circle in Palo Alto

High Cost Example of a Traffic Circle at Rancho San Antonio Park

CURB BULBS (CHOKERS) – CATEGORY 2

Description: Extension of the curb into the former paved street area (backed by sidewalk, landscape and other features) to narrow the street traveled way at intersections and other key locations. These are different from the semi-diverters discussed elsewhere in this document in that they do not extend far enough into the street to block a traffic lane (as do the semi-diverters).

Objective: Enhance pedestrian safety and traffic safety; slow turning traffic, and increase traffic awareness of neighborhood environment.

Neighborhood Traffic Applications: Best used at intersections where there is intent to reduce the length of crosswalks and to place pedestrians at a better driver-pedestrian sight line before pedestrians leave the curb. Used for speed control of turning traffic by creating a smaller turn radius. Controls speed by creating a sense of narrowness. Curb bulbs offer a visual cue to drivers transitioning from an arterial-collector environment to a local access neighborhood environment.

Prerequisites & Constraints: Can be used on any street classification. Curb bulbs cannot be used on streets less than 22 feet in traveled-way width. They cannot be used to narrow the traveled way to less than 22 feet (2-way), or to narrow individual lane width to less than 11 feet. Cut outs may be needed for bike lanes. Design must respect turn radius requirements for common vehicles and gutter flow and drainage inlet requirements. Curb bulbs may require relocation/adjustment of utility valves and manholes.

Advantages: Benefits include reduction in turning vehicle speeds to 15 mph or less, increased pedestrian safety and comfort, minor traffic diversion. May include landscape/urban design features to create "gateway" treatment. May be useful on streets where sideswipe of parked vehicles is a problem. Can be used in staggered configuration to create chicane effect and used at mid-block as well as intersection corners to create portal effects.

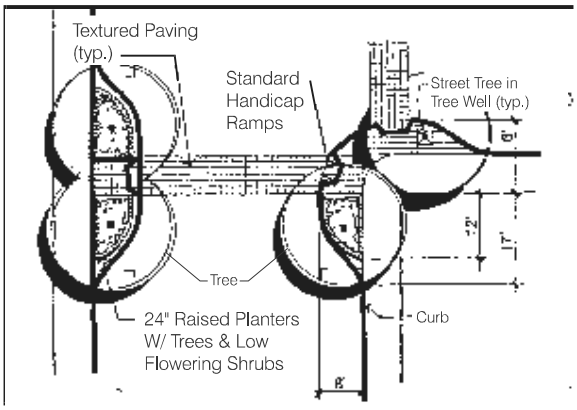
Disadvantages: Through vehicle speeds may not be substantially reduced unless other measures are combined with curb bulbs.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation (one vote per residence). ***All*** residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within one block or 1000 feet; whichever is less, on each side of the proposed choker locations. Written notification to the local fire district must also be issued.

Alternate Devices: Undulations, circles.

Cost (Typical): Per each: $3,000 hardscaped; $8,000 landscaped (not including the additional cost for an assessment district).

Curb Bulbs



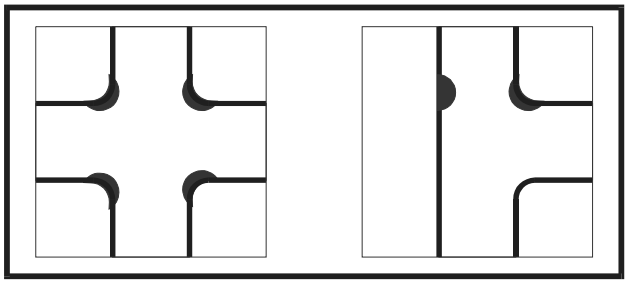


Figure 4a - At Intersection, Most Often Used to Create "Entry or Gateway Effect."

Figure 4b - Staggered at Midblock to Create a Chicane Effect. Planting Heavily Protected by Concrete Planter.

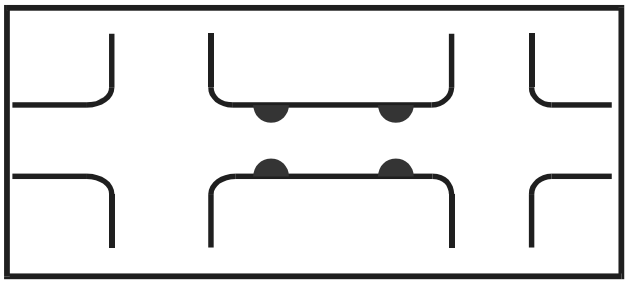


Figure 4c - Paired at Midblock to Create 'Slow Point' Where Opposed Drivers Must Defer to One Another.

Mountain View Example

PEDESTRIAN ISLANDS – CATEGORY 2

Description: Pedestrian islands involve the use of raised islands (includes curb, gutter, landscape or hardscape and other design features) at intersection to provide a midway pedestrian refuge and to block left turn paths that would otherwise cross the centerline to achieve higher speeds. Islands are built along the centerline of a street, or between intersections on a given street to occupy excess traveled-way space.

Objective: Reduce speed of turning traffic at intersections of two-lane roads, or create pedestrian refuges in the middle of long crosswalks.

Neighborhood Traffic Applications: Raised islands at intersection approaches or in curved, mid-block sections are used for two main purposes:

1. To reduce speeds at intersections, typically turning traffic on low volume streets that makes wide, high-speed turns.
2. To reduce mid-block speeds on long blocks with large radius curves.

Prerequisites & Constraints: Pedestrian islands can be placed at intersections with any street type, and can also be placed mid-block on collectors or arterials. The islands require adequate sight distance and absence of severe grades or awkward geometric conditions.

Design details of median islands must include provisions for special emergency vehicle passages at key locations. Handicapped ramps or gaps at pedestrian crossings accommodate bicyclist crossings. Landscaping must not obstruct the line of sight for pedestrians, cyclist, and motorists.

Advantages: Benefits include reduction in turning vehicle speeds to 15 mph or less, increased pedestrian safety and comfort. May include landscape/urban design features to create "gateway" treatment. Islands should not be installed unless a majority consensus exists in the neighborhood.

Disadvantages: Major disadvantage is vehicle strikes, which may result in damage to vehicles and claims against the County. Reflective signs (N or K markers) and curbs painted with white reflective paint are required to minimize vehicle strikes. The islands can also restrict large vehicle turns.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation (one vote per residence). ***All*** residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within one block or 1000 feet; whichever is less, on each direction from the proposed pedestrian island locations.

Alternate Devices: Circles, chokers.

Cost (Typical): Per each: $3,000 hardscaped; $8,000 landscaped (not including the additional cost for an assessment district).

Example of landscaped Pedestrian Island in Sacramento

San Jose Example

MODIFIED TEE INTERSECTION – CATEGORY 2

Description: A curb extension added to the straight, through street at the top of a tee intersection. The minor street, which terminates at the tee is controlled with a stop sign.

Objective: To deflect the travel path of through vehicles, forcing motorists to slow to negotiate the curve.

Neighborhood Traffic Applications: Used on local streets or collectors of any width in situations where there is desire to reduce through traffic. Typically used at tee intersections.

Prerequisites & Constraints: Requires adequate sight distance, absence of severe grade or awkward geometric conditions and available space to provide turning movements for large delivery trucks or emergency vehicles. Relocation or adjustment of drainage, manholes, utility valves or street monumentation may be required.

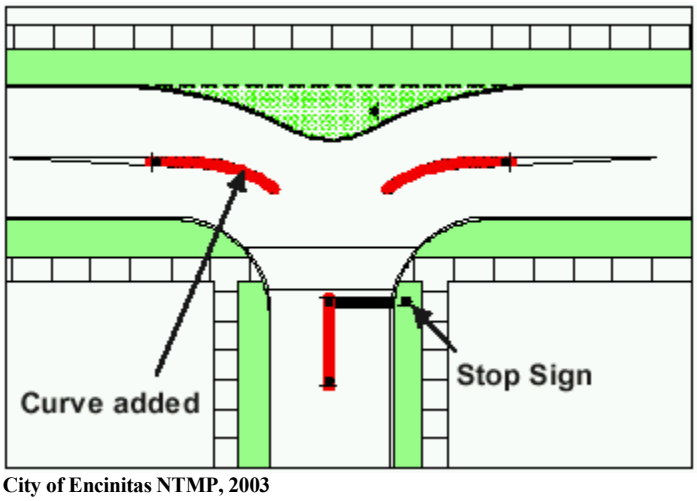
Advantages: Eliminates high speed through movements and can reduce through traffic on through leg of tee.

Disadvantages: Large vehicles may have difficulty maneuvering around the median.

Minimum Requirements: Prior to consideration, a two-thirds majority of the addresses with front or side frontage on the affected area in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition. A petition must be circulated to all households within three blocks or 2,000 feet; whichever is less, of the proposed tee intersection. The petition must show all household addresses. Written notifications to the local fire district must also be issued.

Alternate Devices: Undulations, chokers.

Cost (Typical): $19,000 hardscaped; $27,000 landscaped (not including the additional cost for an assessment district).



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CHICANE – CATEGORY 2

Description: Chicanes are created using curb extensions that alternate from one side of the street to the other to create a single travel lane with S-shaped curves. Chicanes are sometimes referred to as deviations, serpentines, reversing curves, or twists.

Objective: Chicanes rely on a curvilinear path and potential conflict between opposing traffic flows to reduce travel speeds. The design must discourage drivers from cutting straight paths across the centerline or testing their skills on the curves or speed reductions will not occur.

Neighborhood Traffic Applications: Used on local streets less than 26 feet wide and with less than 600 vehicles per day. Streets may be one lane, one-way or two lanes and two-way. Their use is confined to lower volume streets because traffic can pass through the chicane in one direction only.

Prerequisites & Constraints: Requires adequate sight distance, absence of severe grade or awkward geometric conditions and available space to provide turning movements for large delivery trucks or emergency vehicles. Relocation or adjustment of drainage, manholes, utility valves or street monumentation may be required.

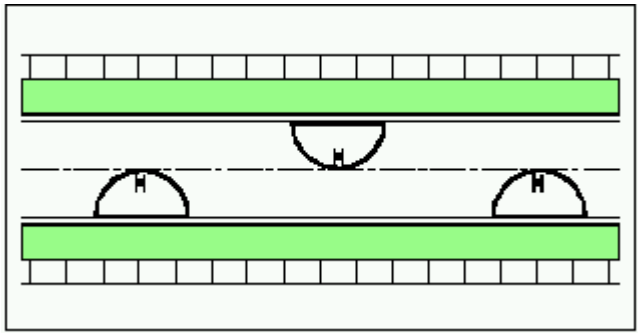
Advantages: Reduces high speed movements.

Disadvantages: It may be necessary to ban parking within the chicane. Increased maintenance may be required. Bicyclists are forced to merge with vehicles on through movements.

Minimum Requirements: Prior to consideration, a two-thirds majority of the addresses with front or side frontage on the affected area in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within three blocks or 2,000 feet; whichever is less, of the proposed chicane. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Undulations, medians, circles.

Cost (Typical): $12,000 hardscaped; $17,000 landscaped (not including the additional cost for an assessment district).



City of Encinitas NTMP, 2003

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INTERSECTION TABLE – CATEGORY 2

Description: An intersection table elevates the entire intersection to sidewalk level. The raised area is often brick or other textured material, which can enhance its calming effect. One or more bollards are placed on each corner to prevent vehicles from cutting across corner space intended for use by pedestrians.

Objective: Forces drivers to slow as they enter and exit an intersection.

Neighborhood Traffic Applications: Used at intersections of narrow streets where traffic circles would not fit. Also used at intersections of local streets and collectors of any width with fewer than 7,500 vehicles per day.

Prerequisites & Constraints: If textured materials are used, a smooth corridor should be provided for people using wheelchairs and other personal assistance devices. Relocation or adjustment of drainage, manholes, utility valves or street monumentation may be required. Intersection tables should not be installed on a primary emergency medical service route or bus route.

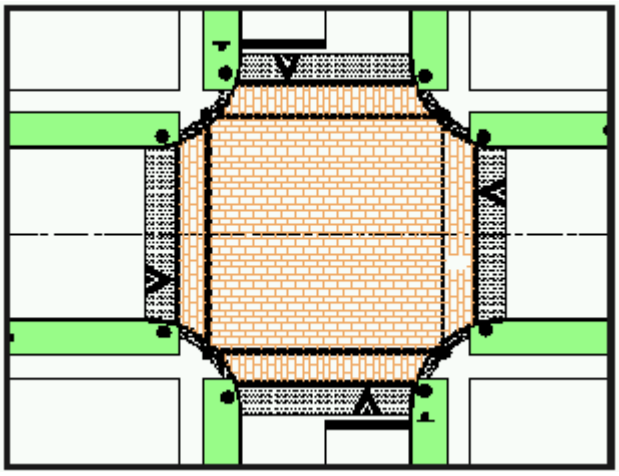
Advantages: Reduces high speed through movements at intersections. Intersection tables place a visual emphasis on the intersection and pedestrians.

Disadvantages: Delays emergency vehicle response times and increases turning difficulty, since drivers must go up a ramp, turn, and go down a ramp.

Minimum Requirements: Prior to consideration, a two-thirds majority of the addresses with front or side frontage on the affected area in question must sign a petition favoring the installation. All residents owning corner lots directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within three blocks or 2,000 feet; whichever is less, of the affected intersection. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Traffic circles.

Cost (Typical): $93,000 to $143,000 (not including the additional cost for an assessment district).



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GATEWAY TREATMENT – CATEGORY 2

Description: Gateways include a variety of treatments at the entrance or entrances to a neighborhood or community. Gateways announce arrival in a unique place, such as a neighborhood of downtown. Many gateways are purely aesthetic or informational and have no impact on drivers unless reinforced with additional treatments within the neighborhood. One form of gateway treatment is a short intersection median that is enhanced with textured pavement to create a physical sensation. Other examples include signs in the center median, wing walls, non-movable gates, and arches over the roadway.

Objective: Reduce speed and broadside collisions and strengthen neighborhood identity.

Neighborhood Traffic Applications: Used on local and collector streets over 26 feet wide. Also used as a divider between commercial and residential areas on the same street.

Prerequisites & Constraints: If textured materials are used, a smooth corridor should be provided for people using wheelchairs and other personal assistance devices. Relocation or adjustment of drainage, manholes, utility valves or street monumentation may be required. Minimum gateway vertical clearance above the traveled way must be adhered to.

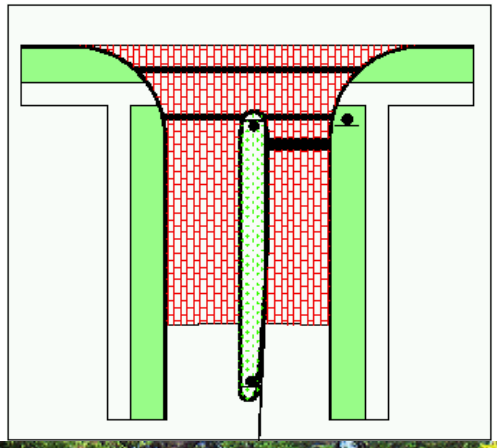
Advantages: Reduces vehicle speed. Gateway treatments separate an arterial street-type environment from a neighborhood environment. Enhances neighborhood identity and provides a landmark.

Disadvantages: Limited effectiveness in changing a driver's tendencies.

Minimum Requirements: Prior to consideration, a two-thirds majority of the addresses with front or side frontage on the affected area in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition. The petition must be circulated to all households within three blocks or 2,000 feet; whichever is less, of the installation(s). The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Pedestrian islands.

Cost (Typical): $36,000 to $54,000 (not including the additional cost for an assessment district).



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TOOL KIT
TRAFFIC-CALMING DEVICES
CATEGORY 3

DIAGONAL DIVERTERS – CATEGORY 3

Description: Uses curb, gutter, sidewalk, centerline striping, signs, markings and other design features to convert two streets intersecting at generally right angles into two unconnected streets, each making a right angle turn at the former intersection.

Objective: Reduce traffic by creating less direct and less convenient routings through neighborhoods.

Neighborhood Traffic Applications: Placed on local access streets experiencing significant through traffic burdens, where some physical restraint of traffic paths is acceptable and desirable, and where the more rigorous restraint of cul-de-sacs is undesired or unacceptable.

Prerequisites & Constraints: May be placed only on local access streets with not more than two lanes. Intersecting streets both must be at least 30 feet in curb-to-curb width to allow adequate space for development of the diverter and the travel lanes. Not acceptable across public transit routes. Diagonal diverters require adequate sight distance and reasonable grade conditions. Prototype designs require site-specific customization.

Used singly or in combination with other devices in neighborhood diversion system. Normally requires assessment of their effects in broad area circulation context, even if not intended as part of a neighborhood system. Effects of diverted traffic must be regarded as acceptable; can shift traffic to other local streets. Reasonable access to "internal" properties and streets must be maintained.

Reconstruction/relocation of manholes, utility valves, drainage inlets and street monumentation and construction of additional fire hydrants may be required. Requires emergency vehicle access features on key emergency service routes. Design features may be included to mitigate effects on bicyclists.

Advantages: Less significant adverse effects on regularly routed services (i.e. refuse collection, school transit) and inconvenience to irregular services (i.e. parcel delivery, moving vans) than cul-de-sacs. Design features can mitigate effects on bicycles and bikeways.

Diagonal diverters create opportunity to reduce street crossings in pedestrian paths to schools, parks and community facilities as well as landscape opportunity. Objective with landscape is to create appearance that streets never actually intersected in the original pattern.

Disadvantages: Can restrict resident and emergency vehicle access to properties. May cause confusion until maps reflect the change.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition (one vote per residence). The affected area will be defined by County staff, and will include current and future paths leading to and from the diverter. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Cul-de-sac, semi-diverter, median island, channelization, turn prohibitions.

Cost (Typical): $10,000 hardscaped; $15,000 landscaped (not including the additional cost for an assessment district).

Diagonal Diverters

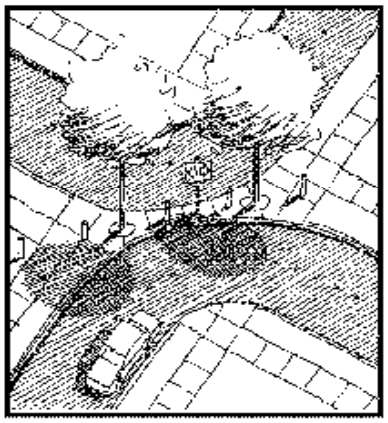


Figure 10a
Diagonal Diverters Change Two Crossing Streets Into Two Unconnected Streets, Each Making a Right-Angle Turn.

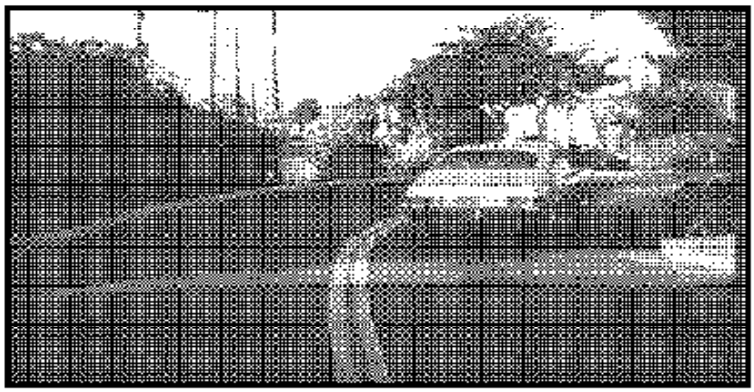


Figure 10b1
Landscape Diverter: Ultimate Objective of Landscape is to Create Apppearance Streets Never Connected.

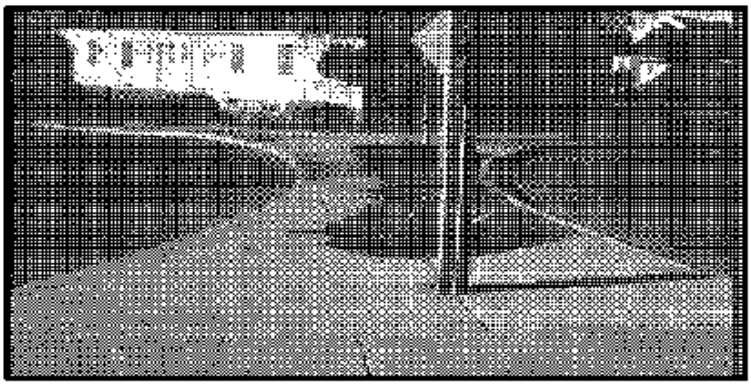


Figure 10b2
Hardscapped Diverters: Can be moderate cost curb, gutter, sidwalk like illustration or low cost bollard construction.

Figure 10b
View illustrates How Diagonal Diverter & Cul-De-Sac Can be Used to Create Safe Pedestrian Paths Across Streets in Neighborhoods to Key Destinations Such as Parks & Schools.

SEMI-DIVERTERS/CHANNELIZATION – CATEGORY 3

Description: Use of curb, gutter, possibly landscape and other features (or use of raised bars or bollards in substitute for curb and gutter) to prohibit specific through or turning moves at intersections.

Objective: Reduce traffic volume; reduce through traffic.

Neighborhood Traffic Applications: Used on local access streets in situations where there is desire to reduce through traffic and are often used in combination with other devices in a neighborhood system. Typically used when existing conditions constitute a severe problem for residents.

Prerequisites & Constraints: Used only on local access streets. They are normally positioned in combination with other devices to force cut-through traffic to use arterial streets. They require adequate sight distance, absence of severe grade or awkward geometric conditions and available space to provide turning movements for large delivery trucks or emergency vehicle. Relocation or adjustment of drainage, manholes, utility valves or street monumentation may be required. Design features may be included to mitigate effects on bicyclists.

Advantages: Can be used effectively where emergency vehicle route considerations limit application of other devices. Can be effective on narrow streets where other devices are problematic. Street name change for separated roads may be appropriate.

Disadvantages: Use can lead to driver resentment. Can lead to access difficulties for existing residents and may be a problem for guests or legitimate deliveries to residents in the project area.

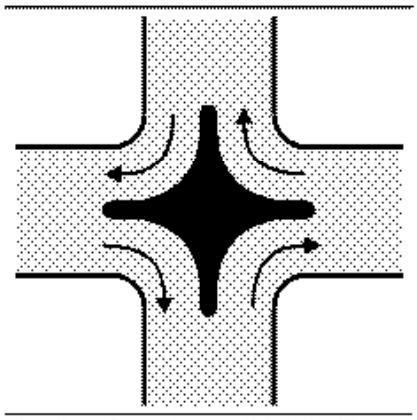
Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition (one vote per residence). The affected area will be defined by County staff, and will include current and future paths leading to and from the semi-diverter. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Diagonal diverter, cul-de-sac, median island, turn prohibitions.

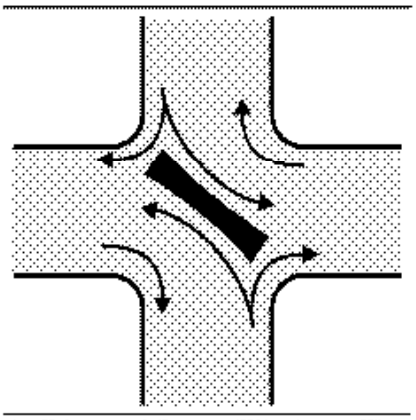
Cost (Typical): $4,000 hardscaped; $6,000 landscaped (not including the additional cost for an assessment district).

Mountain View Example

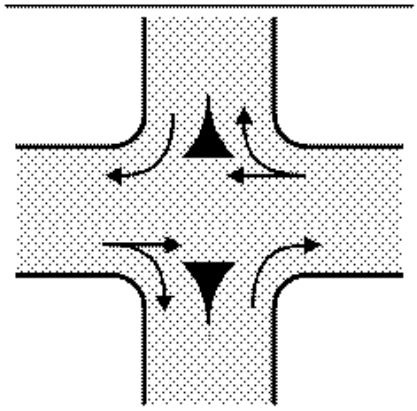
Channelization



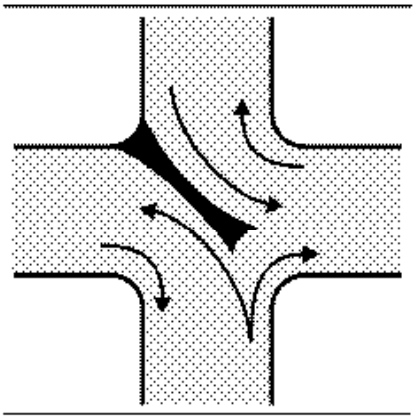
(a) Star Requires All Right Turns



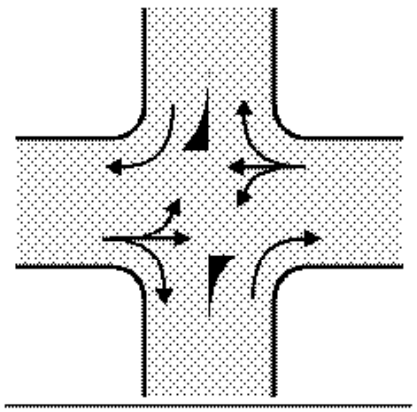
(b) Diagonal Bars - Eliminate Thrus and Some Lefts



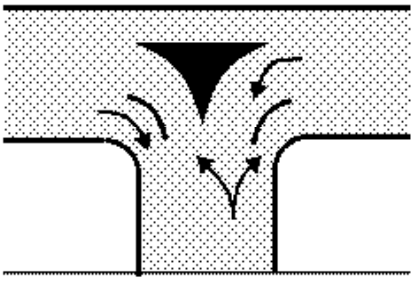
(c) Trumpet Mutes - Requires Right-Turn-Only In & Out on Some Approaches.



(d) Three-Quarter Diverter..



(e) Partial Mutes Requires Right Turns Only on Outbound Movements



(f) On Thru-Streets at "T".

Figure 7 - Channelization Controls Turning Movements at Intersections.

HALF STREET CLOSURE – CATEGORY 3

Description: Use of curb, gutter, possibly landscape and other features (or use of raised bars or bollards in substitute for curb and gutter) to convert a street block formerly accessed at both ends to a two-way street with egress at both ends but with ingress at only one end.

Objective: Reduce traffic volume; reduce particular patterns of through traffic.

Neighborhood Traffic Applications: Used on local access streets in situations where there is desire to reduce traffic but with less rigorous effect than imposed by cul-de-sacs and diagonal diverters or where the desire is to affect a specific pattern of through traffic. Half street closures are often used in combination with other devices in a neighborhood system.

Prerequisites & Constraints: Used only on local access streets. Half street closures are normally positioned to limit ingress rather than egress, since egress restraint traps the unwitting motorist, leading to difficult turn-around maneuvers, driver resentment and frequent avoidance violations. Best placed to control access at arterial boundaries to neighborhoods since placement at secluded locations within neighborhoods are subject to higher rates of violation. The closure requires adequate sight distance, absence of severe grade or awkward geometric conditions. Relocation or adjustment of drainage, manholes, utility valves or street monumentation may be required. Design features may be included to mitigate effects on bicyclists.

Advantages: Can be used effectively where emergency vehicle route considerations limit application of other devices. Are effective on narrow streets where other devices are problematic.

Disadvantages: Can restrict resident and emergency vehicle access to properties. May cause confusion until maps reflect the change.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition (one vote per residence). The affected area will be defined by County staff, and will include current and future paths leading to and from the half closure. The petition must show all household addresses. Written notification by the local fire district must also be issued.

Alternate Devices: Diagonal diverter, cul-de-sac, median island, turn prohibitions, channelization.

Cost (Typical): $4,000 hardscaped; $6,000 landscaped (not including the additional cost for an assessment district).

Example of Low Cost Half Street Closure from Sacramento

Mountain View Example

CUL-DE-SAC – CATEGORY 3

Description: Located at intersection limits or at mid-block. Using curb, gutter, sidewalk, bollards and/or other design features, revises a block with a through traffic pattern to create a block which has traffic ingress and egress at only one end, or at both ends but with through travel eliminated. Cul-de-sacs create a situation similar to streets in new subdivisions that have ingress/egress at one end only.

Objective: Reduce traffic volumes and travel speeds.

Neighborhood Traffic Applications: Used on local access streets with significant through traffic volume. Normally used at intersections except on streets where transitions between residential and other land uses suggest a mid-block location.

Prerequisites & Constraints: Use only on local access streets and unacceptable on collectors and arterials. Not acceptable across public transit routes. Cul-de-sacs require adequate sight distance and reasonable grade conditions. Parking restrictions are usually necessary to create turn-around space at interior(s) of device. Turn-around maneuvers are extremely difficult if used with less than 36-foot curb-to-curb width. Cul-de-sacs may require widening in turn area. Prototype designs require site-specific customization.

Used singly or in combination with other devices in neighborhood diversion system. Normally requires assessment of effects in broad area circulation context, even if not intended as part of a neighborhood system. Reconstruction/relocation of manholes, utility valves, drainage inlets and street monumentation and construction of additional fire hydrants may be required. Requires emergency vehicle access features on key emergency service routes. Special consideration will need to be given to turnaround area for emergency vehicles. Design features can mitigate effects on bicycles and bikeways. This option may not be feasible if the cul-de-sac road length is greater than 150 feet.

Advantages: Provides opportunity to reduce street crossings in pedestrian paths to schools, parks and community facilities as well as landscape opportunity. Objective with landscape is to create appearance that street traffic way never went through cul-de-sac area.

Disadvantages: Potential significant adverse effects on regularly routed services (i.e. refuse collection, school transit) and inconvenience to irregular services (i.e. parcel delivery, moving vans), especially because the turning circle routinely incorporated at the end of cul-de-sacs built in new subdivisions can rarely be developed in the retrofit ones.

Minimum Requirements: Prior to consideration, a two-thirds majority of the residents on the street in question must sign a petition favoring the installation. All residents directly adjacent to the installation(s) must support the petition (one vote per residence). The affected area will be defined by County staff, and will include current and future paths leading to and from the cul-de-sac. The petition must show all household addresses. Written notification to the local fire district must also be issued.

Alternate Devices: Diagonal diverters, semi-diverters, median islands, channelization.

Cost (Typical): $10,000 in hardscape - $15,000 per installation in landscape (cost can vary significantly as result of site conditions and not including the additional cost for an assessment district).

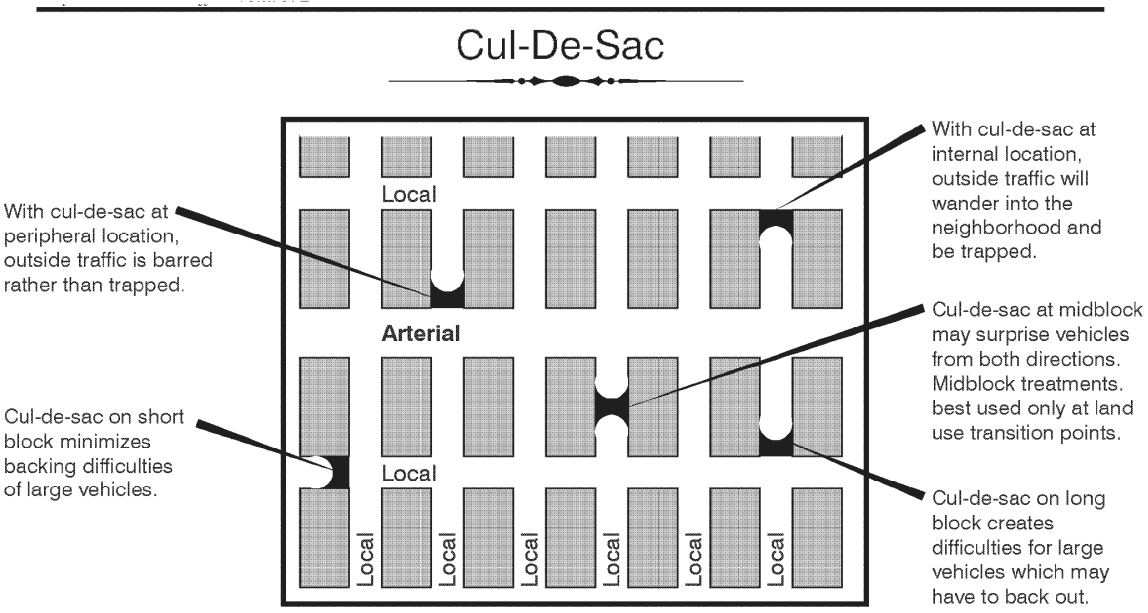


Figure 9a - Cul-De-Sac Location Implications.

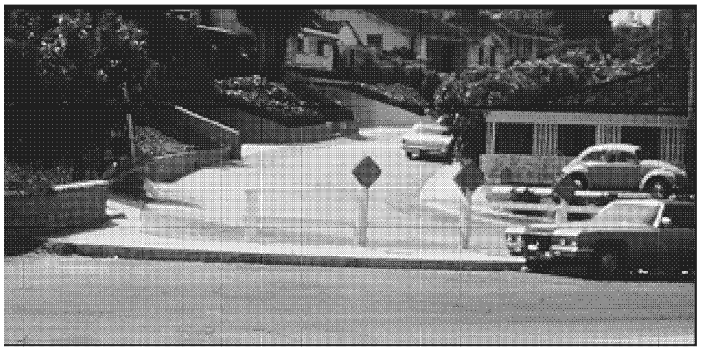


Figure 9b - Hardscaped Cul-De-Sac.

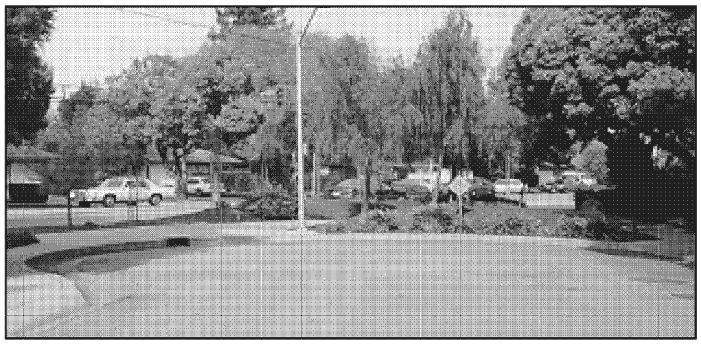


Figure 9c - Landscaped Cul-De-Sac.

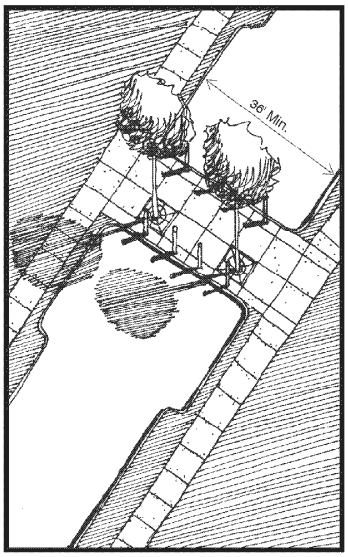


Figure 9d - On Narrow Streets Cul-De-Sac May Necessitate Parking Restriction and or Spot Widening for Adequate Turning.

STOP SIGNS – TRAFFIC CONTROL DEVICE

Description: A regulatory sign placed at intersections which requires drivers to come to a complete stop and assure that it is safe to proceed under the normal right of way rules before proceeding into the intersection.

Objective: Control of right of way at intersections where there is reason to believe that the intersection does or would not operate within reasonable safety expectations if left to operate as an uncontrolled intersection under the general right of way law. Often this is because of factors that obstruct sight distance for vehicles entering the intersection from conflicting approaches.

Neighborhood Traffic Applications: Residents often desire STOP signs as a remedy for perceived collision or pedestrian crossing dangers at intersections, as a traffic diversion device, or for speed control. Requests for neighborhood applications frequently become controversial for two reasons. First, traffic-engineering practice normally requires objective evidence of need for right of way control, rather than just the perception of danger. Second, the use of STOP signs for diversion or speed control is contrary to traffic engineering evidence and opinion, which argues such STOP applications are ineffective for those purposes.

Prerequisites & Constraints: Warrants for STOP signs defined in the *Contra Costa County Transportation Engineering Division – Traffic Polices & Procedures Manual* should be followed at all intersections on streets designated arterials, major collectors and residential. These warrants are incorporated into this document by reference, and are summarized below.

The following warrants are to be used in evaluating appropriateness of STOP signs at uncontrolled residential intersections of local access streets with at least three warrants satisfied:

1. Peak hour volume of fifty (50) vehicles more on the higher volume street

2. Two (2) or more accidents per year that are correctable by stop signs

3. Obstructed sight distance at a critical speed of fifteen (15) miles per hour or less

4. Intersection is in a location where large numbers of elementary school children cross

The warrants for installation of all-way stop signs on residential collectors or minor residential streets are satisfied if all of the following warrants are met:

1. The total vehicular volume entering the intersection from all approaches for any consecutive eight (8) hours of an average day must average 180 vehicles per hour; AND the vehicular volume entering the intersection from the minor street(s) for the same eight (8) hours must average one third (1/3) of the total volume entering the intersection (60 vehicles per hour minimum)

2. Three (3) or more accidents of types susceptible to correction by stop signs within a 12-month period

3. The straight-line sight distance on one or more approaches of the major street for vehicles or pedestrians crossing the intersection is less than 160 feet

4. Both streets have residential frontage with existing 25 mile per hour speed limits

5. Neither street is an adopted Through Street

6. Neither street exceeds forty (40) feet of roadway width, measured from edge of pavement to edge of pavement or face of curb to face of curb

7. No existing stop sign or signal is located on the more heavily traveled street within a distance of 800 feet

8. Intersecting streets extend 800 feet or more away from the intersection

9. Intersection is at a location where a large number of elementary school children cross (minimum of 25 children crossing on an average school day required)

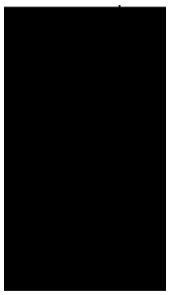
Advantages: Stop signs are readily understood and can be installed quickly and inexpensively. Ineffective as speed control device except within 200 feet of intersection (where it also has the undesired effect of increasing traffic noise). The signs may have some effect on mid-block speeds of the very fastest drivers, while not affecting mid-block speeds of the vast majority of drivers. Ineffective as a traffic diversion device except where travel time using the short-cut route through the neighborhood offers only a small advantage over the travel time using the more appropriate route. Stop signs installed when warrant criteria are not met tend to be disregarded by many motorists and may increase rear-end type accident occurrence.

Minimum Requirements: Prior to consideration, a simple majority of the addresses with front or side frontage on the affected area in question must sign a petition favoring the installation. County warrants criteria must be satisfied.

Alternate Devices: For right of way control: yield sign, traffic signal, and occasionally traffic circles. For speed control: traffic circle, undulations, enforcement are preferable. Diverters, semi-diverters, cul-de-sacs, median barriers, turn prohibitions and channelizations are preferable as diversion devices.

Cost (Typical): $500 per intersection for 2-way STOP; $1000 per intersection for 4-way.

Stop Signs



TRAFFIC SIGNALS – TRAFFIC CONTROL DEVICE

Description: A traffic signal system installed at intersections assigns right-of-way to drivers at the various approach lanes by displaying a red, yellow, or green light.

Objective: Control of right of way at intersections where there is reason to believe that the intersection does or would not operate within reasonable safety or congestion expectations if left to operate as an uncontrolled intersection under the general right of way law.

Neighborhood Traffic Applications: Residents may desire traffic signals as a remedy for perceived crossing dangers at intersections, or for ease of access to or from a neighborhood.

Prerequisites, Limitations & Constraints: Warrants for traffic signals defined in the California Department of Transportation *Traffic Manual* should be followed at all intersections These warrants are incorporated into this document by reference, and generally require a minimum volume of cars on the major and minor streets to demonstrate a net improvement in traffic operations with the traffic signal.

Advantages/Other Considerations: Traffic signals are readily understood. Studies for installation of a traffic signal should typically be independent of a traffic-calming study.

Minimum Requirements: Caltrans warrant criteria must be satisfied.

Alternative Devices: Roundabout (large diameter traffic circle), sight distance improvements.

Cost (Typical): $150,000

DESIGN CONSIDERATIONS

DESIGN CONSIDERATIONS

This section is oriented to engineers and designers who will assist the citizens of Contra Costa County with the design and implementation of their neighborhood traffic plan. Citizens will rely upon the information and tools provided in preceding sections and during neighborhood meetings to develop a plan to address their concerns. Their suggestions must be reconciled with design considerations to create a plan that reflects their wishes but is compliant with guidelines and practices of the engineering profession.

The treatments in the Toolbox include designs that create horizontal or vertical deflection to require motorists to slow down, improve pedestrian crossings, or address other concerns expressed by the public or revealed by safety data. The Toolbox includes a wide variety of treatments to address a range of problems in diverse environments with variable topography and street widths. Treatments, landscape and streetscape elements, traditional access management techniques such as raised medians and right-in, right-out turn lanes, and lane markings can be used in a variety of combinations to address speeding and high levels of cut-through traffic on neighborhood streets. Treatments are generally designed to fit into existing rights-of-way with minimal new infrastructure construction, utility relocation and repair.

Traffic management in a neighborhood must be holistic. That is, the placement of each treatment must solve problems throughout the neighborhood, and not move the problem from one location to another. The designer must consider the impacts that traffic calming treatments may have on nearby areas or the overall traffic circulation patterns.

The needs of all who share the roadway environment, including bicyclists, pedestrians, transit vehicles, delivery vehicles, emergency service providers, and passenger vehicles must be considered and balanced. Special needs for visually impaired people or those using wheelchairs, walkers, and baby strollers must be accommodated. Existing landscaping, neighborhood character, and many other contextual elements must be factored in, and the public input is of great importance in any design. Normal procedures including environmental review required for construction plan approval must be followed.

Overall Design Review

Variable conditions in the roadway environment make it essential that traffic-calming treatments be designed for each specific site, rather than done as a “cookie cutter” approach. The designer needs to experience the problem by undertaking field reviews to gain a complete understanding of the problem and to review site conditions. Following the site review for each treatment the designer uses the basic layouts described in the following pages to confirm that the treatment chosen by the residents is the best treatment for each location. If for whatever reason, drainage problems, utility conflicts, negative impact on driveways etc., the designer can change the recommended treatment to a more suitable treatment for that location.

Design Speed

Design speed is a critical element for each traffic-calming treatment. Establishing design speed allows each treatment to be designed according to road function and the problem to be treated. The table below summarizes suggested design speeds for the traffic-calming treatments based on functional classification of the roadway.

Roadway Classification Design Speed
Local 12 – 15 mph
Collector 15 – 20 mph

Spacing

Each traffic-calming treatment has an effective range beyond which drivers return to their previous driving habits. Treatments must typically be installed at intervals of 400 to 800 feet to obtain a consistent change in driver behavior. Treatments spaced more closely than 400 feet apart could evoke dissatisfaction among residents. Spacing treatment over 800 feet apart will provide drivers with an opportunity to reach high speeds. Varying the type of traffic calming measure requires drivers to adopt different driving techniques at each location.

Driveways

Traffic-calming treatments need to be located away from driveways, or in such a way that they do not completely block driveways. Turning restrictions to ingress and egress are sometimes necessary. Driveway access at roundabouts can be preserved in many designs, and reversing into a roundabout from a driveway, in the same manner as drivers have traditionally backed into traffic, may be acceptable on a low volume street.

Intersections

In most instances, capacity at neighborhood intersections where traffic-calming treatments are planned is not an issue. Topography, drainage, driveway location, radii, and street width can affect treatment design. It is important that vehicle turning requirements are checked. The use of turning templates is encouraged to check each intersection design. In some cases the treatment suggested during the neighborhood workshop may need to be changed. In this case, the designer should document and explain the reason for the change during the follow-up meeting.

In the past, some intersections were constructed at skewed angles and with very large radii. Some have large areas of asphalt and accommodate high speed turning movements. One consequence of this intersection design is that drivers who enter a neighborhood at high speeds tend to maintain or increase their speed as they move further into the neighborhood. Redesigning to AASHTO guidelines may involve realigning the intersection angles as near as possible to 90 degrees, minimizing the area of asphalt, and using channelization to minimize conflicts. Examination of existing vehicle paths can help determine the extent of asphalt needed. Excess asphalt can be changed to landscape space. Provision of a raised median on some or all of the intersection approach legs can help slow traffic, reduce the openness of the intersection and provide pedestrians with refuge islands. Often the addition of a median is more effective than simply reducing the turn radii. The use of vehicle turning templates can help determine the best design approach.

Turning Templates

The use of templates for the design vehicle when designing traffic-calming treatments is essential. Determine which vehicles must travel along the route to select the appropriate template. In some cases it may be practical to make a minor adjustment to a vehicle's route so the design does not have to accommodate an occasional large vehicle. This should be a County and neighborhood decision.

Traffic Signals

Traffic signals are not considered traffic-calming treatments. The function of a traffic signal is to transfer time from one street to another. Anecdotal evidence suggests that drivers tend to speed up along their route to compensate for time spent waiting at a signal or in an attempt to avoid a "stop" signal. Signals can, however, affect traffic calming in nearby areas. Cut-through traffic can be averted by modifying existing traffic signal phasing or duration on the collector roads. For example, the green time on the arterial or collector road that is parallel to a cut-through route can be increased to encourage drivers to stay on the main road. Signals can also be modified at the entrance to a subdivision to reduce the green time on a designated approach and discourage cut-through traffic.

Emergency Vehicles

Traffic-calming treatments that are effective in slowing or diverting vehicles have the same or greater impact on emergency vehicles. Sudden vertical deflection can be jarring and uncomfortable for passengers in fire trucks, which are longer and have stiffer suspension than passenger vehicles. Vertical deflection treatments may have an even greater effect on ambulances that are transporting patients.

Most traffic-calming treatments have little or no impact on emergency response time because they are mostly located in the last link (street) on an emergency response route.

Design elements can be added to treatments to improve emergency vehicle maneuvering and access. For example, traffic circles can be built with mountable aprons, which allow fire trucks to pass through an intersection without compromising the measure's effectiveness in slowing passenger vehicles. Emergency service providers are supportive of the program and must be consulted to provide input on any traffic calming design (i.e. where mountable curb may be required to accommodate their vehicles).

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act, 42 U.S.C. 12101 et seq., requires removal of architectural barriers to provide access for disabled people. Federal regulations mandate installation of curb ramps or slopes to accommodate access to streets. Any alteration to a facility that may affect its usability, such as installation of a physical device in the street or a change to the curbing or sidewalk, triggers the obligation to construct curb ramps or other appropriate accommodations for the entire facility. Most traffic-calming treatments fit this criteria and the designer should be aware of any required ADA improvements at the start of design.

Sidewalks

Sidewalks should be constructed in compliance with current County standards.

Raised Islands

Raised islands are to be constructed to acceptable standards within typical minimums of 18 inches in width and a minimum area of 50 square feet. AASHTO guidelines suggest offsets for approach vehicles are important to provide vehicles with some forgiving space. Raised islands can be solid concrete pinned to the asphalt or the road pavement can be excavated and full depth curbing provided. The interior of the islands can be filled with plain or colored and stamped concrete, paved with brick, or landscaped. The inclusion of a gutter can permit drivers to take a slightly faster path through the treatment. Whenever possible, the gutter should be included as part of the travel way when determining deflection. If the gutter is not needed, (i.e. the road slopes away from the island) then curb only around the island is preferred.

Drainage

Design of traffic-calming treatments must address drainage, as many traffic control treatments can impede existing drainage flows and patterns.

The flow area along the roadway may be constrained to the width of the gutter when a raised island is added. When water is constrained to the gutter, the upstream flow area may become wider and water will eventually flow around the raised island.

A bulb out or speed table is designed to slow traffic and does not lose that characteristic during rainstorms. Traffic is expected to be moving at a speed that would preclude hydroplaning through pooled water.

Traffic-calming treatments installed on streets with unimproved shoulders generally do not have a significant impact on drainage. The designer should still exercise care in these situations to avoid creating a drainage or erosion problem.

Fire hydrants and water meters

Existing water meters and fire hydrants should be relocated to conform to current standards whenever the curb and sidewalk are relocated for traffic-calming treatments. Water meters for landscape irrigation should be installed wherever landscaping is included in a traffic calming measure. Backflow prevention devices are recommended to be located in areas that are least impacted by pedestrian traffic.

Visibility

Traffic-calming treatments must be clearly marked and signed in compliance with the MUTCD or according to the County's conventional practices. The MUTCD includes signs that are standard, or mandatory, and signs that are optional. Careful discrimination must be

used in the selection of signs in order to prevent confusing sign clutter that could arise if all possible signs are installed.

Concrete curbs dictate vehicle paths in traffic-calming treatments and should provide drivers with a smooth travel path free of kinks or sudden changes in direction. Curbs should be set back from painted gore areas on approaches to most traffic-calming treatments.

Raised pavement markers should always be used to improve night visibility of traffic-calming treatments. Raised pavement markers can serve two purposes in some traffic calming treatments: they delineate the road centerline during after dark hours, and when closely spaced, the markers discourage drivers from crossing the centerline at any time.

Lighting and landscaping must also be incorporated into traffic-calming treatments to enhance visibility and ensure that drivers can identify the object and respond appropriately. It should never be assumed that the existing lighting is adequate. Some treatments may require additional safety lighting at the discretion of the County Engineer. Increasing the lighting to suitable levels could mean installing additional poles, increasing the wattage of existing street lights, or modifying light fixtures.

Landscaping

Landscape elements for traffic-calming treatments must be selected to support a slow speed environment. Limit shrub height to 2.5 feet in areas with driveways or pedestrians, or where sight-lines are critical. Careful selection and placement of plant materials and traffic-calming treatments can improve existing sight triangles. Mid-block traffic-calming treatments may contain denser plantings than at intersection treatments because sight triangles are usually less critical on straight roadway sections. Plantings with low water needs are preferred to limit saturation of base and subgrade road materials.

Trees can be planted in medians, bulb outs, planter strips, and near the edges of most streets. They should not be planted in a "clear zone." AASHTO defines the clear zone as the space between a fixed physical object and the travel way. The clear zone varies according to street function. In residential areas where vehicles travel at low speeds, the clear zone is three feet. In some constrained conditions, the clear zone is reduced to 1.5 feet. Where parking or bike lanes are used, the parking lane or bike lane edge is the edge of the travel way. Trees can be planted at the edge of the curb and still be within AASHTO guidelines. The visual impact of street trees is greater when they are planted close to the street. When trees are planted in median areas root barriers are recommended.

Most neighborhood streets have sewer and water pipes that need to be protected from tree roots. Tree roots typically occupy the top eighteen inches of soil where they need room to gather water and nutrients and anchor the tree. For some trees, the extents of the root system can be a length that is 1-1/2 times the height of the tree. If trees are to be planted near underground or overhead utility lines, tree type selection and the use of root barriers or concrete jackets around pipes are to be considered.

The benefits of trees include increased property value, reduction in air pollution, and a reduction in storm water runoff. (Urban trees in Vancouver collectively provide 55 million cubic feet of storm water reduction, a benefit valued at $331.6 million.) These and other facts related to urban trees should be considered when construction costs are analyzed.

Tree Selection Guidelines

When selecting the location and size of trees, the designer or reviewer should consider the following guidelines to determine if mature size and location of plant material will affect safety:

- Draw the approaching vehicle.
- Draw the driver's head within the standard position within the vehicle.
- Draw the tree at its mature trunk and canopy thickness.
- Draw the conflicting vehicle.
- Draw two lines from the approaching driver's head toward the conflicting vehicle that just touches each side of the tree trunk.
- If the sight triangle that is developed covers less than 50% of the conflicting vehicle, the driver obviously will not lose sight of it. Even at 75% blockage, the conflicting vehicle is visible to the driver. If the coverage is greater, the simple solution is to move the tree several feet away from the approaching driver and redraw the sight triangle.

Lighting

Landscaping may impact street lighting at traffic-calming treatments. Additional lights may be needed to improve or maintain visibility of the street and traffic-calming treatments. In the "dark" areas of the County, additional or extensive use of raised pavement markers may be required. Additional signing and high visibility markings to highlight traffic-calming treatments may also be required.

Maintenance Issues

The introduction of traffic-calming treatments will increase street maintenance. Traffic-calming treatments should be incorporated into existing curb lines when possible to minimize maintenance. The minimum radii from curb line to the beginning of a traffic-calming treatment should be 15 feet to permit mechanical street sweeping. Those treatments that cannot provide the minimum curb radii will have to be swept by hand on a periodic basis.

Ongoing inspection and maintenance of markings and signs that identify traffic-calming treatments is critical for proper operation. Traffic-calming treatments are to be checked as part of the overall sign and marking inspection program.

Where irrigation systems are installed, maintenance requirements will vary with each system. Battery operated controllers require battery replacement at regular intervals. Other controllers require a power supply and meter. Solar powered irrigation controllers may provide a viable alternative that offers reduced maintenance and installation cost.

Tree canopies should be under-trimmed to provide 14.5 feet of clear trunk height measured from the top face of curb or the edge of pavement. Tree canopies above sidewalk are required to be under-trimmed to provide 7 feet of clear trunk height.

Treatment Design

Because of the wide variety of environments and problems, it is neither feasible nor desirable to provide standard templates for each treatment. It is incumbent on the engineer to fully understand the problem and needs and adjust to the basic design to meet the situation. To assist in this process, comments on each treatment are discussed below. Each heading includes the Toolbox page number for the treatment.

Modified Tee Intersection – refer to page 35

There are several techniques for modifying the priority of Tee intersections. The standard treatment is shown in the Toolbox. An alternate design is to permit the through movement farthest from the terminating leg to be a straight through movement with the reverse through movement diverted to their right if this layout better suits the problem being addressed.

Intersection Table – refer to page 39

An intersection table allows all movements by all vehicles, an advantage over some roundabouts. To ensure vehicles stay within the intersection area, bollards or other barriers must be placed around the right turn radii. The intersection table is also widened to encompass the pedestrian crosswalks so pedestrians do not have to step down and up at the curb lines.

Radii Reduction, Curb Extensions, and Bulb Outs – refer to page 31

Some intersections have large radii that permit higher than desirable turning speeds. In these cases, reducing the turn radii and extending the curb into the street to create a curb extension will reduce the pedestrian crossing distance and turning speed of vehicles. It is important to determine the design vehicle requirements when selecting radii for either of the above changes. In some cases the right turn exit radii of a street can be smaller than the entry radii. According to AASHTO, it is permissible to require large vehicles to turn across the centerline of the street they are entering.

Drainage must be addressed because bulb outs can reduce on-street drainage capacity and disrupt gutter flow. On streets with existing curbs and streets where no major drainage improvements are planned, the existing gutter flow can be adjusted so the water flows along the new curb line. This may require adjusting the length and location of the bulb-out to accommodate an existing inlet, moving the existing inlet, or installing a new inlet on the upstream side of the bulb-out to convey storm runoff to an existing inlet.

Other Considerations:

- Vertical curbs are to be used unless mountable curbs are necessary to accommodate turning trucks and buses.

- A transition radius as small as 6 feet is acceptable at bulb out connections to existing curbs, but a 15-foot radius is preferred, when possible, to facilitate street sweeping. The larger radius also makes it easier for drivers to park their vehicles.
- Combine mid-block bulb-outs and crosswalks whenever possible.
- Driveways can be accommodated by locating driveway aprons along the bulb-out edges or by shortening the bulb out so it does not encroach into the driveway.
- If a bicycle lane is marked, the bulb out should not encroach into the lane.

Signing and Marking – refer to page 31

An edge stripe with raised pavement markers (RPM) is used to define the edge of the travel way and/or edge of the street parking. If a bulb-out diverts two travels lanes into one, striping and signing is required in order to direct vehicles into the inner lane.

Short Medians at Intersections/Gateways – refer to page 41

Short medians at intersections provide a number of benefits. When designing them it is useful to consider that the turning paths of vehicles turning out of a street is often narrower than the path when making a left or right turn into the street. Therefore, the exit lane can be narrower than the entry lane into the street. Typically, the exit lane can be narrowed to 10 or 11 feet with the entry lane being widened to approximately 14 feet. Use of truck templates is important to confirm the chosen lane widths.

Partial Closure – refer to page 49

The design of this treatment requires careful consideration regarding drainage and street sweeping. They can have square ends, which require manual sweeping of the gutters or radii that permit mechanical street sweeping.

Median Barrier – refer to page 33

A cut-through should be provided in the median for pedestrian and bike crossings. Median barriers can become useful as pedestrian refuges if they are six or more feet wide.

Diagonal Closure – refer to page 44

It is important to ensure pedestrian and bicycle access across the diagonal closure. Bicycle access can be provided with a cut-through of the diagonal diverter. A barrier is sometimes necessary within the diagonal diverter to stop vehicles from driving over the treatment. Trees are useful for blocking errant vehicles and highlighting the treatment from a distance.

Street Closure – refer to page 51

There are many techniques to close streets, from a simple barrier to conversion of a whole block to a park or playground. Treatments with extensive landscaping can change what can be an unattractive barrier to an appealing landscaped area. The closure can be extended to

the first driveway to maximize landscape area. Bike access and sidewalks through the treatment are essential. In rare cases, a driveway section can be provided through the center of the treatment with frangible posts that the emergency vehicles can break if they absolutely must go through the treatment.

Chicanes – refer to page 37

The most important part of chicane design is to ensure that the edge of each chicane island reaches the street centerline. It may be necessary to ban parking within the chicane. Chicanes are most effective where traffic volumes are balanced in each direction. Placement of chicanes will depend on site conditions such as driveway locations.

Medians on Curves – refer to page 33

Typically, medians on curves are to be a minimum of 18 inches wide. In some cases where this is not possible, the use of large pavement markers that are typically 8 to 12 inches wide placed at a 90 degree angle to the travel lane can provide a substantial barrier to drivers who wish to cut across the centerline of the street. It is important to provide openings in the medians at driveways. In some cases, the openings may be spaced such that the median will have to be extended around the curve and along the straight section of the road to provide reasonable visibility of the median.

Speeds Humps and Speed Tables – refer to page 24 & 27

It is important to ensure that ramps and treatment height is not too low or ramp tapers too long. If the rate of change in vertical position is too forgiving, drivers will be able to go over these treatments at a fast rate of speed. The ends of speed humps and speed tables are also critical parts of the design. When the ends are designed in a forgiving, easy taper, drivers can put one set of wheels in the gutter and go over the speed hump at high speeds, sometimes in excess of 40 mph. Vertical curb to deter this behavior is preferred.

Centerlines

Centerlines create certainty. They provide drivers with clear information regarding placement and offset of approaching vehicles. This allows drivers to proceed with certainty and be comfortable traveling at higher speeds. The loss of certainty when the centerline is removed helps to slow drivers, particularly on short streets.

Bike Lanes

Bike lanes designate travel space for bicyclists and increase rider comfort and the predictability of bicyclist movements. This added travel space also makes it feasible for motorists to encroach into the space designated for bicyclists and travel faster through or around traffic calming treatments. Limiting bike lanes to streets with more than 1,500 vehicles per day prevents this adverse impact in residential areas. There are generally few conflicts between bicyclists and vehicles in low-speed, low-volume residential areas.

In places where bike lanes are provided, the designer must be aware that motorists will drive over painted lines and adjust the design accordingly. One technique is to move curb extensions or islands between the bike lanes and the treatment. Care must be taken to ensure the design does not set up potential conflicts between pedestrians and bicyclists.

On Street Parking

On-street parking should be encouraged on all residential streets. Parked vehicles can narrow the street to a single lane, forcing drivers to pull into driveways or empty spaces between parked vehicles to let an opposing vehicle pass. This reduces the speed of both vehicles.

RANKING PROJECTS

A rating system, see Table 1, will be utilized in order to enable competing local street traffic calming projects to be ranked in relation to the anticipated benefit. Similarly a rating system, see Table 2, will be utilized in order to enable competing local collector street traffic calming projects to be ranked in relation to the anticipated benefit. If multiple projects are competing for traffic calming funds, ranking will be based on total points and project cost. Traffic calming projects must score a minimum of 30 points in order to be considered for implementation.

Traffic speed and volume usually precipitate the request for traffic calming within a neighborhood. Traffic crashes are added as extra points because a crash problem usually coincides with higher volumes and speed.

Residential density also affects general traffic conditions. For example, higher densities tend to generate more pedestrian and vehicle turn movements. In addition, projects on higher density streets tend to benefit more people than projects on lower density streets. The other criteria, sidewalks, school crossings, and pedestrian generators, are important considerations because they relate to pedestrian safety.

Table 1

Project Point Assignment
Local Streets

CRITERIA	POINTS	BASIS
Speed (85th %tile)	0 to 40	10 pts for every 5 mph over posted speed limit
Volume	0 to 40	ADT divided by 100
No Sidewalks	0 to 10	5 pts if no continuous sidewalk, 5 pts if signs of heavy pedestrian traffic w/out sidewalks
Traffic Crashes	0 or 5	1 pt for each crash/year at one location
School Crossing	0 or 5	5 pts if children must cross street to get to school
Total Points Possible	100	

Table 2

Project Point Assignment
Collector Streets

CRITERIA	POINTS	BASIS
Speed (85th %tile)	0 to 30	5 pts for every 5 mph over posted speed limit
Volume	0 to 25	5 pts for every 1,000 ADT on any one street
Traffic Crashes	0 to 15	1 pt for every 2 crash/year at one location
No Sidewalks	0 or 10	5 pts if no continuous sidewalk, 5 pts if signs of heavy pedestrian traffic w/out sidewalks
Residential Density	0 to 5	1 pt for every 100 dwelling units/mile
School Crossing	0 or 5	5 pts if children must cross street to get to school
Pedestrian Generators	0 or 5	5 pts if pedestrian generator
Transit Availability	0 or 5	5 pts if not on transit route
Total Points Possible	100	

GLOSSARY

Access
The ability to enter and/or exit a property, street or neighborhood; includes both ingress and egress

ADT
Average daily traffic, or the number of vehicles that travel a roadway in one 24-hour weekday period

Arterial
A signalized street that primarily serves through-traffic and that secondarily provides access to abutting properties, with signal spacing of 2.0 miles or less

Assessment District
A funding source developed by the local jurisdiction to collect funds from property owners in addition to property taxes that will pay for the installation and maintenance of landscape improvements that will directly benefit the residents of the immediate area

Chokers and Bulb-Outs
An extension of the curb towards the center of a street, either in the mid-block or at the intersection, used to narrow the roadway to slow traffic

Chicane
An artificial curve added to an otherwise straight street

Collector
A surface street providing land access and traffic circulation within residential, commercial and industrial areas

Cul-de-sacs
Complete closure of the street, either at intersections or at mid-block, to completely block access from one end of a street while allowing adequate turnaround

Diagonal Diverter
Barrier placed diagonally across an intersection to convert the intersection into two unconnected streets to break up through routes

Forced Channelization
Similar to diverter; used to force traffic to right or left

Grade
A vertical incline; can be either uphill or downhill

ITE Trip Generation Handbook
The Institute of Traffic Engineers (ITE) professional manual that compiles surveys of the amount of vehicle trips generated by land use type

Ingress and Egress
The ability to enter (ingress) and exit (egress) a property, street or neighborhood, such as a driveway serving a parking lot

MUTCD
Manual on Uniform Traffic Control Devices published by the U.S. Department of Transportation – Federal Highway Administration

Mid-block
Any point between successive intersections along a street

NTC
Neighborhood Traffic Committee

NTMP
Neighborhood Traffic Management Plan

NTP
Neighborhood Traffic Plan

Necked Intersection
Similar to a choker or a bulb-out placed at an intersection; used to narrow the intersection to slow traffic

One-Way Entrance and Exit
Similar to a diverter; used to prohibit entrance or exit into or out of a street or neighborhood

Pavement Undulation
They are raised pavement areas across a roadway that are generally 3 to 4 inches high with a travel length of 12 to 14 feet; a.k.a. Speed Hump

Prima Facie Speed Limit
The established speed limit in the California Vehicle Code that need not be posted for various situations, i.e.25 miles per hour on local resident streets

Private Road
A road not owned or maintained by the governing local agency; is not required to meet any specific standards of construction and may not be available for use by the general public

Public Road
A road owned and maintained by the governing local agency; is designed to meet generally accepted roadway standards and is available for general public use

Raised Medians
They are used to control turning movements and provide pedestrian refuge

Roundabout
These are similar to traffic circles but have splitter islands that prevent trucks from turning in front of the circle

Rumble Strips
Patterned sections of rough pavement, used as a means of attracting the driver's attention

Safe Stopping Distance
A distance of sufficient length that a driver can brake within to avoid striking an unexpected obstacle on the roadway; a.k.a. safe sight distance

Semi-Diverters
Partial street closures which limit access to a street from one direction by blocking half the street

Speed Bump
A raised pavement area across a roadway and generally has a height of three to six inches with a travel length of one to three feet

Speed Hump
Raised pavement section across a roadway that generally has a height of three to four inches with a travel length of 12 to 20 feet; a.k.a. Pavement Undulation

Speed Survey
A survey of vehicles performed with radar to determine the speed at which they are traveling. The 85th percentile speed is commonly used as the indicator of the appropriate roadway speed limit. Radar may be used to enforce a speed limit set with a radar survey

Speed/Warning Signs
Speed limit signs and signs warning motorists of traffic conditions such as speed humps or schools

Sight Distance
The maximum distance at which a driver can clearly see an oncoming vehicle, a stopped vehicle or an obstacle in the roadway; this distance is often reduced by the vertical and horizontal alignment of a roadway as well as other obstructions along the roadway such as vegetation, buildings and signs

Traffic Calming
A technique for reducing the speed and volume of traffic on residential streets that uses various traffic control/calming devices

Traffic Calming Devices
A general category of physical devices used to reduce traffic volume and speed, used primarily in residential areas utilizing such devices as speed humps, chicanes, bulbs and diverters

Traffic Circle
Round raised islands placed at the center of an intersection. They are typically effective tools as intersection calming devices

Traffic Control Devices

A general category of physical devices used to direct and control traffic, such as traffic signals and stop signs

Vpd
Vehicles per day

ENDNOTES

1. Speed Hump Placement Criteria, City of Pleasant Hill. (http://www.pleasanthill.ca.gov/PublicWorks/speed_hump.pdf). This section discusses the factors influencing the decision to place speed humps on streets with respect to vehicle speeds, accident history, and impact to emergency service providers and neighboring residential streets.

ADDITIONAL RESOURCES

City of Encinitas Neighborhood Traffic Management Program, 2003

City of Pleasant Hill Traffic Calming Policy

City of Delray Beach Neighborhood Traffic Calming Policy & Guidelines
http://www.mydelraybeach.com/Delray/Departments/Environmental+Services/Quick+Links

PETITION – PHASE I

We the undersigned are concerned about traffic volumes and/or travel speeds in our neighborhood. We urge Contra Costa County to implement measures to address our concerns, which may include the following:

- Public outreach
- Speed limit signs
- Use of a speed-radar trailer that displays a speed limit sign and the actual travel speed of a passing motorist
- Targeted law enforcement

Address	**Name and Signature of resident** (must be 18 or older)
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:

Instructions:

1. Attach a map of the project area.
2. Make copies as needed, circulate to obtain signatures.
3. Before circulating petition, write the addresses of homes in the project area.
4. Deliver original petition to the County Public Works office after the required number of signatures is obtained.

PETITION – PHASE 2

We the undersigned are concerned about traffic volumes and/or travel speeds in our neighborhood. We urge Contra Costa County to install traffic calming devices shown on the attached plan to address our concerns. We agree that these devices should be tested for a minimum period of 6 months, and will only be removed by request of a simple majority of residents.

Address	**Name and Signature of resident** (must be 18 or older)
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:
	Printed Name: _____ Signature:

Instructions:

1. Before circulating petition, write the addresses of homes in the project area.
2. Prepare a map of proposed traffic calming devices, showing the device locations and addresses of residences in the project area.
3. Make copies as needed, circulate to obtain signatures.
4. Deliver original petition to the County Public Works office after the required number of signatures is obtained.

TRAFFIC DATA

Street Name: _____ Date: _____

Cross Street: _____ Direction: _____

Contact Person: _____ Phone: _____

Date / Time	**Observation**[1]
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Instructions:

1. This form can be used for recording date and times that high speed drivers are noted, recording speeds, traffic counts, or license plate information. If used for logging high-speed drivers, include the day of week in the Observations column.